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Revision 2
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U.S. Department of Energy
Idaho Operations Office

Plume Evaluation Field Sampling Plan for Operable Unit 3-13, Group 5, Snake River Plain Aquifer

INEEL
Home of Science and Engineering Solutions
Idaho National Engineering and Environmental Laboratory

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ABSTRACT

This field sampling plan describes the sampling activities that will be conducted in association with interbed and water sampling from the Snake River Plain Aquifer down-gradient from the Idaho Nuclear Technology and Engineering Center. Samples will be collected from discreet zones within several monitoring well locations in order to determine the horizontal and vertical distribution of contamination within the aquifer. Under this plan, four additional wells/boreholes will be constructed and sampled to determine the extent of contamination above, within, and below the HI interbed stratigraphic unit. Interbed geophysical and chemical samples, as well as aquifer water chemical samples, will be collected to support refined modeling of the tritium, strontium-90, and iodine-129 plumes within the aquifer. Data obtained from this sampling and modeling program will be used to evaluate the need to implement the contingent remedy, and, if required, to evaluate the remedial design/remedial action alternatives identified in the Operable Unit 3-13 Record of Decision.

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FIGURES

TABLES

ACRONYMS

AA	alternative action
ARDC	Administrative Records and Document Control
AT	analysis type
CFA	Central Facilities Area
CFR	Code of Federal Regulations
CoC	chain-of-custody
COC	contaminant of concern
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
DQO	data quality objective
DR	decision rule
DS	decision statement
EM	environmental management
EPA	Environmental Protection Agency
ER	environmental restoration
ES&H	environment, safety, and health
ES&H/QA	environment, safety, and health/quality assurance
FFA/CO	Federal Facility Agreement and Consent Order
FSP	Field Sampling Plan
FTL	field team leader
FUM	facilities, utilities, and maintenance
gpm	gallons per minute
HASP	Health and Safety Plan
HSO	health and safety officer
IH	industrial hygienist

INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
JRC	job requirements checklist
JSS	job site supervisor
MCP	management control procedure
OU	operable unit
PM	project manager
PPE	personal protective equipment
PRD	program requirements documents
PSQ	principal study question
QA	quality assurance
QAPjP	quality assurance project plan
QA/QC	quality assurance/quality control
QC	quality control
RCT	radiological control technician
RI/FS	remedial investigation feasibility study
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SC	safety coordinator
SH&QA	safety, health, & quality assurance
SMO	Sample Management Office
SOP	Standard Operating Procedure
SRPA	Snake River Plain Aquifer
USGS	United States Geological Survey
WAG	waste area group

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1. INTRODUCTION

The Idaho National Engineering and Environmental Laboratory (INEEL) is divided into 10 waste area groups (WAGs) to better manage environmental operations mandated under a Federal Facility Agreement and Consent Order (FFA/CO) (Department of Energy-Idaho Operations Office [DOE-ID] 1991). The Idaho Nuclear Technology and Engineering Center (INTEC), formerly the Idaho Chemical Processing Plant, is designated as WAG 3. Operable Unit (OU) 3-13 encompasses the entire INTEC facility and was investigated to identify potential contaminant releases and exposure pathways to the environment from individual sites as well as the cumulative effects of related sites. Ninety-nine release sites were identified in the OU 3-13 Remedial Investigation Feasibility Study (RI/FS), of which 46 were shown to have a potential risk to human health or the environment (DOE-ID 1997). OU 3-14 was created to specifically address activities at the tank farm area where special actions will be required. The 46 sites were divided into seven groups based on similar media, contaminants of concern (COCs), accessibility, or geographic proximity. The OU 3-13 Record of Decision (ROD) (DOE-ID 1999) identifies remedial design/remedial action objectives for each of the seven groups. The seven groups are

- Tank Farm Soils (Group 1)
- Soils Under Buildings and Structures (Group 2)
- Other Surface Soils (Group 3)
- Perched Water (Group 4)
- Snake River Plain Aquifer (Group 5)
- Buried Gas Cylinders (Group 6)
- SFE-20 Hot Waste Tank System (Group 7).

The following Field Sampling Plan (FSP) has been prepared for the Department of Energy (DOE) to detail the installation and sampling of Snake River Plain Aquifer (SRPA) monitoring wells located near the INTEC facility in support of the WAG 3, OU 3-13, Group 5, SRPA project activities. This FSP, which is one part of a two-part Sampling and Analysis Plan (SAP), is defined as a secondary document under the FFA/CO. The second part of the SAP is the Quality Assurance Project Plan (QAPjP). The governing QAPjP for this sampling effort will be the QAPjP for WAGs 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites (DOE-ID 2000a). The QAPjP is incorporated herein by reference. This FSP is also prepared in accordance with the requirements of Management Control Procedure (MCP)-227, "Sampling and Analysis Process for Environmental Management Funded Activities" (INEEL 1997a). This FSP has been prepared pursuant to guidance from the Environmental Protection Agency (EPA) on the preparation of SAPs (EPA 1986) and the United States Army Corps of Engineers, Environmental Management (EM) 200-1-3, *Requirements for the Preparation of Sampling and Analysis Plans* (USACE 1994). This FSP details the field activities that will be performed, while the QAPjP details processes and programs that will be used to verify that the data generated are suitable for their intended uses. Table 1-1 is a listing of documents, herein incorporated by reference, that will be used to support the activities.

Table 1-1. Applicable and/or related requirements and documents[1]

Document ID	Title
DOE-ID-10587	*Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10 and Inactive Sites, Revision 6, September 1999.*
DOE/ID-10782	*Monitoring System and Installation Plan for Operable Unit 3-13, Group 5, Snake River Plain Aquifer*
GDE-7003	"Levels of Analytical Method Validation"
Manual # 14A	*Safety and Health-Occupational Safety and Fire Protection*
Manual # 15B	*Radiation Protection Procedure*
MCP-226	"Well Construction/ Well Abandonment"
MCP-227	"Sampling and Analysis Process for CERCLA and D&D&D Activities"
MCP-425	"Radiological Release Surveys and the Disposition of Contaminated Materials"
MCP-444	"Characterization Requirements for Solid and Hazardous Waste"
MCP-598	"Corrective Action System"
MCP-2811	"Design Control"
MCP-2864	"Sample Management"
MCP-3003	"Performing Pre-Job Briefings and Post-Job Reviews"
MCP-3562	"Hazard Identification, Analysis and Control of Operational Activities"
MCP-6825	"Construction, Management, and Demobilization of a Temporary Decontamination Pad"
PRD-25	"Activity Level Hazard Identification, Analysis, and Control"
TPR-4910	"Logbooks for ER and D&D&D Projects"
TPR-4911	"Chain of Custody, Sample Handling, and Packaging for ER and D&D&D"
TPR-6575	"Decontaminating Sampling Equipment in the Field"
TPR-6570	"Sampling Groundwater "
TPR-6565	"Core Subs Sampling"
TPR-4908	"Handling and Shipping Samples for ER and D&D&D" (in preparation)
TPR-6541	"Decontaminating Sampling Equipment"
TPR-6557	"Drilling and Installing Monitoring Wells"
TPR-6562	"Abandoning Groundwater Wells and Boreholes"
TPR-6566	"Measuring Groundwater Levels"

[1] The most current procedures, requirements, revisions, and guidance documents pertinent to this project will be employed as work tasks are conducted.

1.1 Project Description

The WAG 3 ROD establishes two remediation goals for the aquifer (1) "preventing current onsite workers and nonworkers during the institutional control period from ingesting contaminated drinking water above the applicable State of Idaho groundwater standards or risk-based groundwater concentrations," and (2) "in 2095 and beyond, ensure that SRPA groundwater does not exceed a cumulative carcinogenic risk of 1×10^{-4}, a total hazard index of 1, or applicable State of Idaho groundwater quality standards" (ROD Section 8, p 8-3 [DOE-ID 1999]).

The first remediation goal will be met by maintaining institutional control over the area of the identified SRPA contaminant plume south of the current INTEC security fence for as long as contaminant levels remain above groundwater standards or risk-based groundwater concentrations.

This project is aimed at determining the actions required to meet the second goal of "in 2095 and beyond, ensure that SRPA groundwater does not exceed a cumulative carcinogenic risk of 1×10^{-4}, a total hazard index of 1, or applicable State of Idaho groundwater quality standards." A flowchart presenting the conceptual design of the WAG 3 Group 5 field activities is shown as Figure 1-1. The flowchart details the steps to be taken to both arrive at a contingent remedy decision and to perform the SRPA interim monitoring. The two separate flow paths are identified on the chart. This FSP is intended to control data acquisition in support of decisions required for the contingent remedy design.

This project will collect samples and data to determine the COC concentrations within the SRPA and above, below, and within the HI interbed stratigraphic unit (HI is the nomenclature for the interbed located between the H and I basalt flow beds) (Anderson 1991). In addition, geophysical samples will be collected of the HI interbed stratigraphic unit. These data are required to determine if current groundwater concentrations for COCs exceed the modeled action levels. The WAG 3 RI/FS model predicted I-129 hot spot is shown in Figure 1-2.

To ensure that drilling and sampling would occur within the contamination plume, available field data were reviewed and a sensitivity analysis on the HI interbed assumptions was performed. This analysis was performed to identify hydrologic data gaps, refine the predicted I-129 hot spot location, select existing wells for sampling, and determine how variations in data input would affect the selection of additional wells for drilling and sampling and their location. The sensitivity analysis is included as Appendix C of DOE-ID 2000b.

As no physical characteristics or COC concentration data were available from the HI interbed to confirm the model predictions and no sensitivity analysis was performed during the WAG 3 RI/FS, the COC data from the SRPA and the physical properties of the HI interbed south of INTEC will be used to support evaluation of this predictive groundwater model.

Under this project, four aquifer wells/boreholes will be constructed and sampled. Aquifer water samples will be collected above, from within, and below the HI interbed stratigraphic unit.

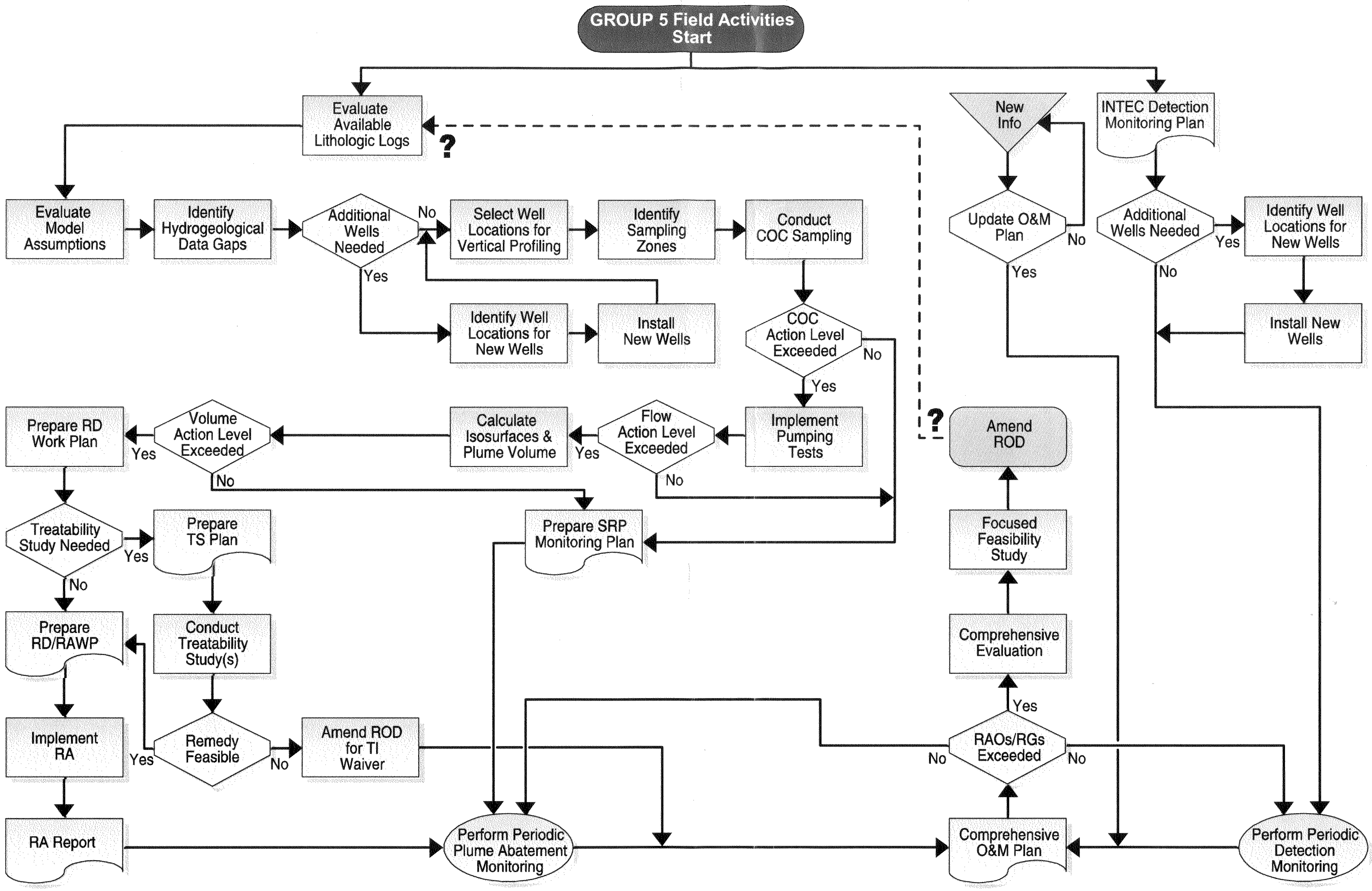


Figure 1-1. Group 5 Snake River Plain Aquifer flow chart.

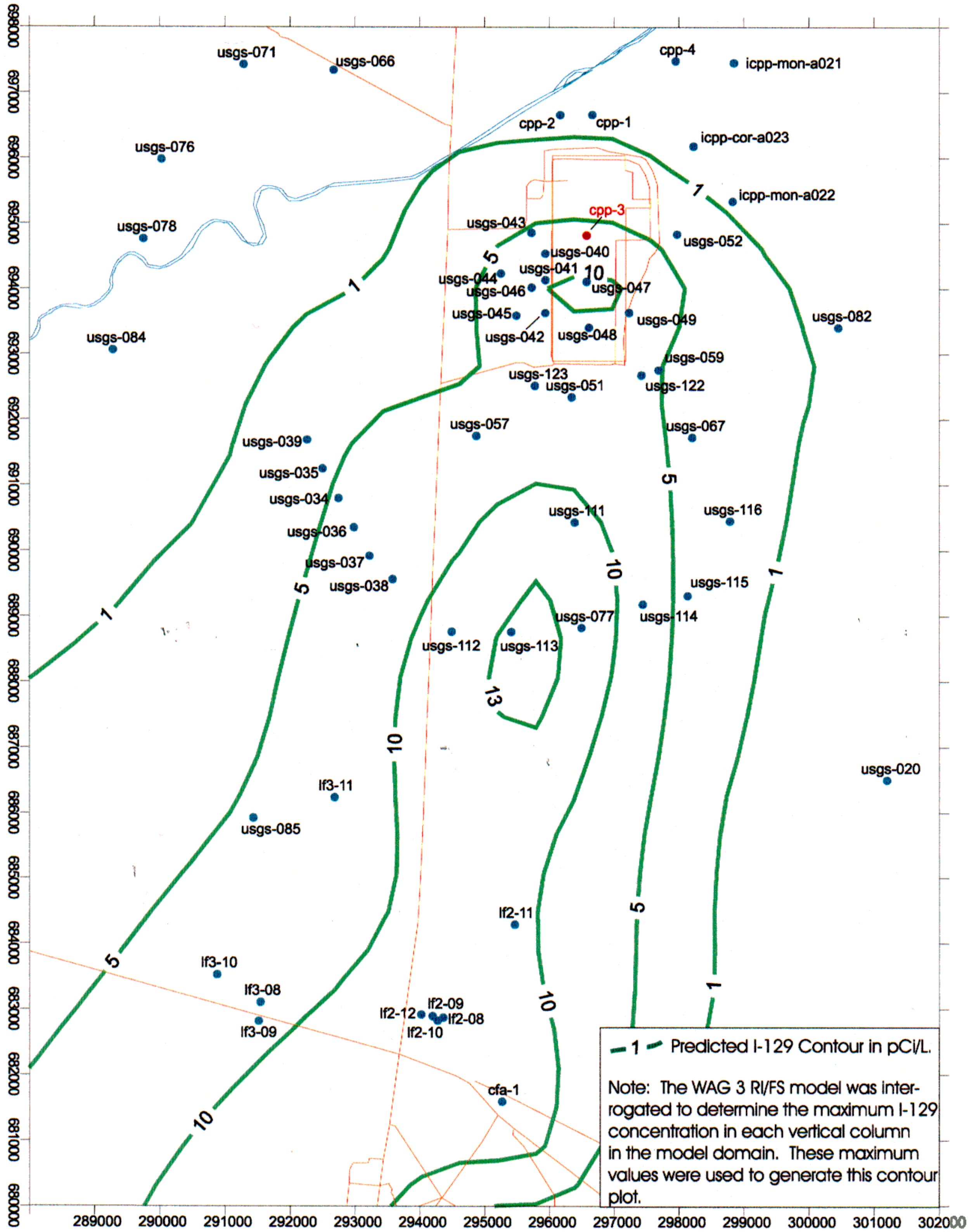


Figure 1-2. WAG 3 RI/FS model predicted maximum I-129 concentrations for 1992.

1.2 Site History

The INEEL is a U.S. Government-owned facility managed by the DOE. The eastern boundary of the INEEL is located 52 km (32 mi) west of Idaho Falls, Idaho. The INEEL site occupies approximately 2,305 km^2 (890 mi^2) of the northwestern portion of the Eastern Snake River Plain in southeast Idaho. The INTEC facility covers an area of approximately 0.39 km^2 (0.15 mi^2) and is located approximately 72.5 km (45 mi) from Idaho Falls, in the south-central area of the INEEL as shown in Figure 1-3. INTEC has been in operation since 1952. The plant's original mission was reprocessing spent nuclear fuel from defense-related projects for the recovery of enriched uranium, and for research and storage of spent nuclear fuel. The DOE phased out the reprocessing operations in 1992 and redirected the plant's mission to (1) receive and temporarily store spent nuclear fuel and other radioactive wastes for future disposition, (2) manage current and past wastes, and (3) perform remedial actions.

The facility produces approximately 3.8 million (M) liters (1 M gal) of wastewater a day. This wastewater consists primarily of demineralizer backwash, cooling water, and steam condensate. Prior to 1984, this wastewater was disposed to an onsite deep injection well; use of the well was discontinued in 1984 when the new percolation pond came online. Contaminants disposed in the injection well were primarily tritium (H-3) and strontium-90 (Sr-90), although elevated levels of iodine-129 (I-129) have also been detected. After 1984, only a single emergency use of the injection well occurred in 1986. The injection well was permanently abandoned in 1989. Under the FFA/CO, this well was designated as Chemical Processing Plant-23.

The United States Geological Survey (USGS) has installed and sampled 33 aquifer wells around the INTEC facility since the late 1940s. Data from all previous sampling events (USGS and INTEC) were included in the OU 3-13 RI/FS (DOE-ID 1997).

1.3 Contaminants of Concern

The COCs identified in the OU 3-13 RI/FS are primarily radionuclides. The COCs listed in the WAG 3 ROD, with the potential to exceed groundwater standards after 2095, are Sr-90, 1-129, and H-3.

1.4 Site-Specific Sampling and Analysis Problems

No analytical problems are anticipated. Water and interbed samples will be subjected to standard chemical analyses. Chemical analyses will be conducted for only the COCs listed above.

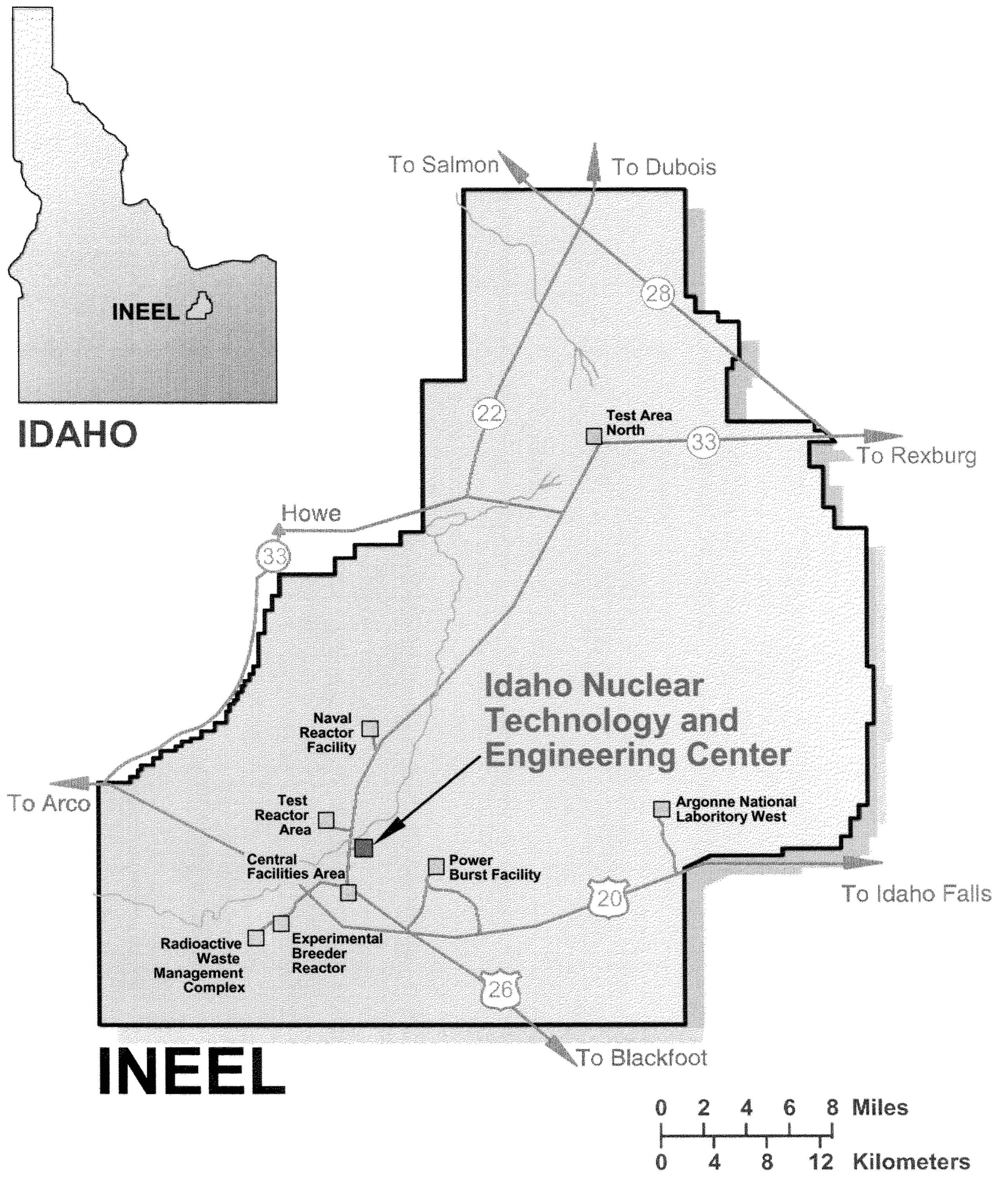


Figure 1-3. Map showing location of the INTEC at the INEEL.

2. PROJECT ORGANIZATION AND RESPONSIBILITIES

The organizational structure for this project reflects the resources and expertise required to perform the work, while minimizing the risks to worker health and safety. As outlined in the FFA/CO, each of the three signatory agencies (DOE, EPA, and the Idaho Department of Health and Welfare/Division of Environmental Quality) has assigned a WAG project manager (PM). The WAG PM's responsibility is to oversee the effective implementation of actions stated in final action documents (i.e., the INTEC OU 3-13 ROD). This section is divided into two subsections that outline the responsibilities of key Bechtel BWXT Idaho, LLC work site personnel only. Section 2.1 discusses key personnel who will be directly associated with the job site (i.e., onsite personnel). Section 2.2 discusses those positions that will supply support for the activities in the field but are not required to be onsite. Job titles of the individuals who will be filling key roles at the work site, and lines of responsibility and communication are shown on the chart in Figure 2-1.

2.1 Job Site Personnel

2.1.1 Project Manager

The PM coordinates all document preparation, field, laboratory, and modeling activities associated with this project. The PM shall ensure that all activities conducted during the project comply with INTEC Site Director requirements as outlined in MCP-2798, "Maintenance Work Control" (INEEL 1998a) and MCP-3003," Performing Prejob Briefings and Post-Job Reviews" (INEEL 1998b), and program requirements documents (PRDs) as well as all applicable Occupational Safety and Health Administration, EPA, DOE, U.S. Department of Transportation, and State of Idaho requirements, and that tasks comply with the QAPjP, the project Health and Safety Plan (HASP), the project Waste Management Plan and this FSP.

The PM is also responsible for the overall scope, schedule, and budget of this project. The PM will oversee preparation, review, and implementation of this FSP to ensure work is performed as planned. The PM is responsible for (1) developing resource-loaded, time-phased control account plans based on the project technical requirements, budgets, and schedules and (2) assigning project tasks. Other functions and responsibilities of the PM related to completion of field activities include the following:

- Developing the site-specific plans required by the Environmental Restoration Program such as work plans, HASPs, FSPs, and waste management plans
- Ensuring that project activities and deliverables meet schedule and scope requirements as described in the FFA/CO Attachment A "Action Plan for Implementation of the Federal Facility Agreement and Consent Order" (DOE-ID 1991) and applicable guidance
- Coordinating and interfacing with units within the program support organization on issues relating to quality assurance (QA), environment, safety, and health (ES&H), and National Environmental Policy Act support for the project
- Coordinating the site-specific data collection, review for technical adequacy, and data input to an approved database such as the Environmental Restoration Information System
- Coordinating and interfacing with subcontractors to ensure milestones are met, adequate management support is in place, technical scope is planned and executed appropriately, and project costs are kept within budget.

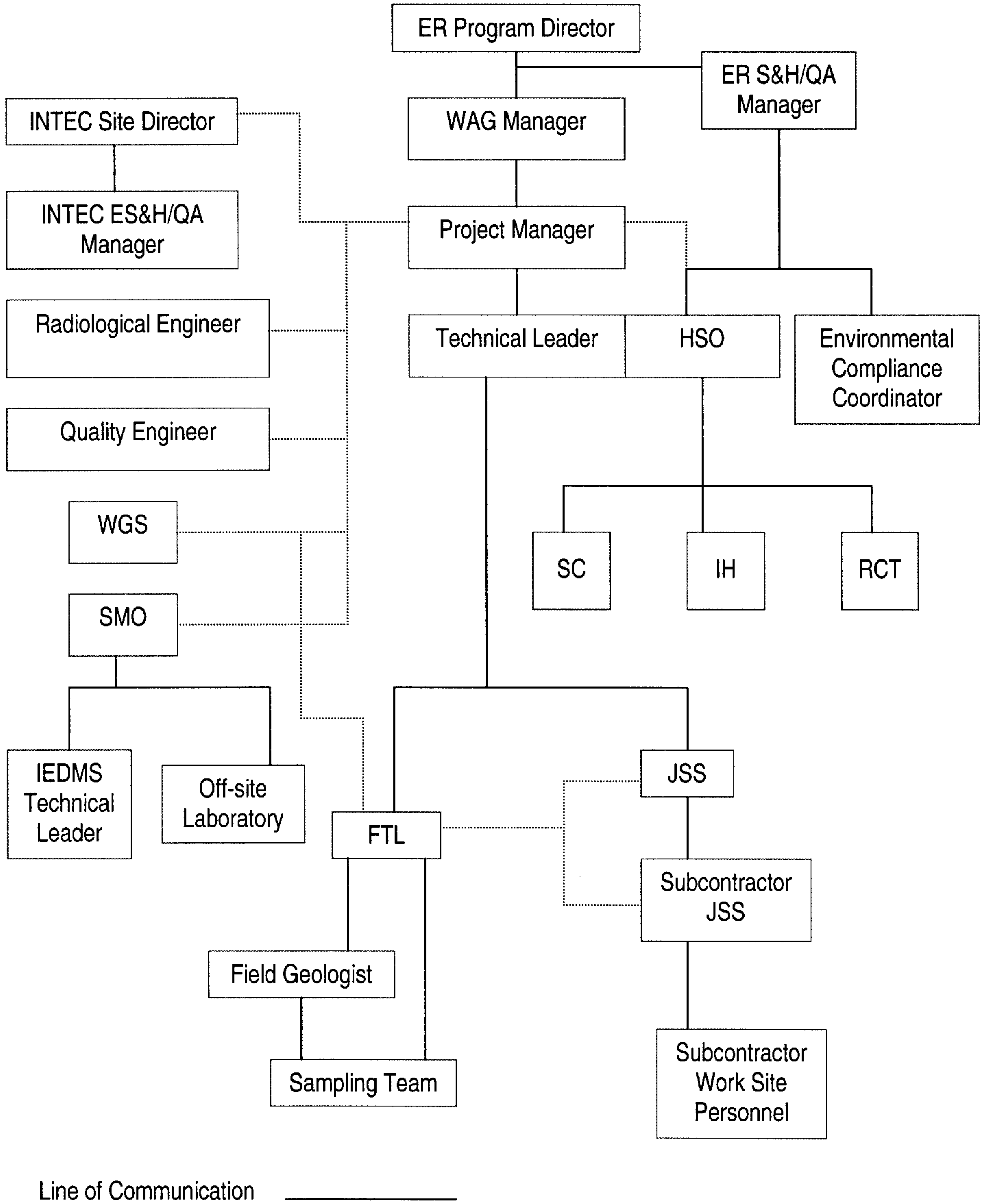


Figure 2-1. BBWI organizational structure for this project.

2.1.2 Field Team Leader

The field team leader (FTL) represents the ER organization at the job site and has delegated responsibility for the safe and successful completion of the project. The FTL works with the PM to manage field sampling or operations and to execute the work plan. The FTL enforces work site control, documents activities, and may conduct the daily safety briefings at the start of the shift. Health and safety issues must be brought to the attention of the FTL.

If the FTL leaves the job site, an alternate individual will be appointed to act as the FTL. Any other individual who acts as the FTL on the job site must meet all the FTL training requirements as outlined in the project HASP. The identity of the acting FTL shall be conveyed to work site personnel, recorded in the FTL logbook, and communicated to the INTEC director, or designee, when appropriate.

The FTL shall comply with the requirements outlined in MCP-3003, "Performing Prejob Briefings and Post-Job Reviews," by completing the briefings and reviews and submitting the documentation to the INTEC Site Director and ER Environment, Safety, and Health/Quality Assurance (ES&H/QA) Manager. The FTL shall complete the job requirements checklist (JRC) as per MCP-2798, "Maintenance Work Control."

The FTL shall be responsible for ensuring compliance with waste management requirements and coordinate such activities with the Environmental Compliance Coordinator or designee.

2.1.3 Health and Safety Officer

The health and safety officer (HSO) is the person located at the work site who serves as the primary contact for health and safety issues. The HSO shall assist the FTL on all aspects of health and safety, which include complying with the Enhanced Work Planning process, and is authorized to stop work at the work site if any operation threatens worker or public health and/or safety. The HSO may be assigned other responsibilities, as stated in other sections of the project HASP, as long as they do not interfere with the primary responsibilities stated here. The HSO is authorized to verify compliance to the HASP, conduct inspections, monitor decontamination procedures, and require and monitor corrective actions, as appropriate. Other ES&H professionals at the work site, including the safety coordinator (SC), industrial hygienist (IH), radiological control technician (RCT), radiological engineer, environmental compliance coordinator, and facility representative, may support the HSO, as necessary.

The person assigned as the HSO, or alternate HSO, must be qualified (per the Occupational Safety and Health Administration definition) to recognize and evaluate hazards and will be given the authority to take or direct actions to ensure that workers are protected. While the HSO may also be the IH, SC, or in some cases the FTL (depending on the hazards, complexity, and size of the activity involved, and required concurrence from the ER Safety, Health, and Quality Assurance [SH&QA] Manager) at the work site, other task-site responsibilities of the HSO must not conflict, either philosophically or in terms of significant added volume of work, with the role of the HSO at the work site.

If it is necessary for the HSO to leave the work site, an alternate individual will be appointed by the HSO to fulfill this role. The identity of the acting HSO will be recorded in the FTL logbook, and work-site personnel will be notified.

2.1.4 Industrial Hygienist

The assigned IH is the primary source for information regarding nonradiological hazardous and toxic agents at the task site. The IH shall assist the FTL in completing the JRC and assess the potential for worker exposures to hazardous agents according to the contractor Safety and Health Manual (INEEL 1997b), MCPs, and accepted industry IH practices and protocol. By participating in work site characterization, the IH assesses and recommends appropriate hazard controls for the protection of work site personnel, operates and maintains airborne sampling and monitoring equipment, reviews for effectiveness, and recommends and assesses the use of personal protective equipment (PPE) required in the project HASP (recommending changes as appropriate).

Following an evacuation, the IH, in conjunction with other recovery team members, will assist the FTL in determining whether conditions exist for safe work site reentry as described in the project HASP. Personnel showing health effects (signs and symptoms) resulting from possible exposure to hazardous agents will be referred to an Occupational Medical Program physician by the IH, their supervisor, or the HSO. The IH may have other duties at the work site, as specified in the project HASP, or in PRDs and/or MCPs. During emergencies involving hazardous materials, airborne sampling and monitoring results will be coordinated with members of the Emergency Response Organization.

2.1.5 Radiological Control Technician

The assigned RCT is the primary source for information and guidance on radiological hazards. The RCT will be present at the job site during any work operations when a radiological hazard to personnel may exist or is anticipated. The RCT shall also assist the FTL in completing the JRC. Responsibilities of the RCT include (1) radiological surveying of the work site, equipment, and samples; (2) providing guidance for radioactive decontamination of equipment and personnel; and (3) accompanying the affected personnel to the nearest INEEL medical facility for evaluation if significant radiological contamination occurs. The RCT must notify the FTL of any radiological occurrence that must be reported as directed by the Radiation Protection Manual (INEEL 1997c). The RCT may have other duties at the job site as specified in the project HASP, or in PRDs and/or MCPs.

2.1.6 Field Geologist

The field geologist will be responsible for the proper identification and logging of all collected core samples. In consultation with the PM and FTL, the field geologist will recommend optimum locations for borehole instrumentation based on core and geophysical data. The field geologist will also oversee all downhole instrumentation installation performed by a subcontractor (i.e., drilling contractor).

2.1.7 Job Site Supervisor

The job site supervisor (JSS) serves as the representative for the Facilities, Utilities, and Maintenance (FUM) Department, Site Services Branch at the task site. The JSS is the supervisor of crafts and other FUM personnel assigned to work at the job site. The JSS is the interface between FUM and ER and works closely with the FTL at the work site to ensure that the objectives of the project are accomplished in a safe and efficient manner. The JSS and FUM, work as a team to accomplish day-to-day operations at the job site, identify and obtain additional resources needed at the job site, and interact with the HSO, IH, SC, RCT, and/or radiological engineer on matters regarding health and safety. The JSS, like the FTL, must be informed about any health and safety issues that arise at the work site and may stop work at the job site if an unsafe condition exists. The JSS also shares the FTL's responsibility for daily pre-job briefings.

2.1.8 Subcontractor Job Site Supervisor

A subcontractor JSS serves as the subcontractor safety representative at the work site. The subcontractor JSS may also serve as the subcontractor PM. The subcontractor JSS is the subcontractor field supervisor for subcontractor personnel assigned to work at the job site. The subcontractor JSS and FTL work as a team to accomplish day-to-day operations at the work site, identify and obtain additional resources needed at the work site, and interact with the HSO, IH, SC, RCT, and/or radiological engineer on matters regarding health and safety. The subcontractor JSS, like the FTL, must be informed about any health and safety issues that arise at the work site and may stop work at the job site if an unsafe condition exists. The subcontractor JSS will provide information to the FTL regarding the nature of their work for input at the daily pre-job briefing.

2.1.9 Sampling Team

The sampling team will perform the onsite tasks necessary to collect, package, and ship samples. Tasks may include the physical collection of sample material, completion of chain-of-custody (CoC) and shipping request forms, and proper packaging of samples in accepted shipping containers (properly labeled and sealed coolers). The size and makeup of the sampling team will be dependent on the extent of the sampling task. The IH and RCT will support the sampling team when sampling is performed inside the contamination area. The sampling team may be lead by the FTL or a designated sample team lead.

2.1.10 General Site Worker

All general site workers shall understand and comply with the requirements of the project HASP. The FTL or JSS will brief work site personnel at the start of each shift. During the pre-job briefing all daily tasks, associated hazards, engineering and administrative controls, required PPE, work control documents, and emergency conditions and actions will be discussed. Input from the project HSO, IH, and RCT, and/or radiological engineer to clarify task health and safety requirements will be provided. All personnel are encouraged to ask questions regarding site tasks and to provide suggestions on ways to perform required tasks in a more safe and effective manner based on the lessons learned from previous days activities.

Once at the job site, personnel are responsible for identifying any potentially unsafe situations or conditions to the FTL, JSS, or HSO for corrective action. All work site personnel are authorized to stop work immediately if they perceive that an unsafe condition poses an imminent danger. They must then notify the FTL, JSS, or HSO of the unsafe condition. Training requirements are outlined in the project HASP.

2.2 Supporting Personnel

2.2.1 Environmental Restoration Director

The ER Director has ultimate management and operations contractor responsibility for the technical quality of all projects, maintaining a safe environment and the safety and health of all personnel during field activities performed by or for the ER Program. The ER Director provides technical coordination and interfaces with the DOE-ID. The ER director ensures that

- Project/program activities are conducted according to all applicable federal, state, local, and company requirements and agreements
- Program budgets and schedules are approved and monitored to be within budgetary guidelines
- Personnel, equipment, subcontractors, and services are available
- Direction is provided for the development of tasks, evaluation of findings, development of conclusions and recommendations, and production of reports.

2.2.2 CFA Site Director

The Central Facilities Area (CFA) Site Director has the authority and responsibility to ensure proper ownership review of all activity outside of facility perimeters and for all work processes and work packages including, but not limited to, the following:

- Establishing and executing monthly, weekly, and daily operating plans
- Executing the INTEC ES&H/QA program
- Executing the Integrated Safety Management System for INTEC
- Executing the Enhanced Work Planning for INTEC
- Executing the Voluntary Protection Program in the area
- Ensuring environmental compliance within the area
- Executing that portion of the voluntary compliance order that pertains to the area
- Correcting the root cause functions of the accident investigation in the area
- Correcting the root cause functions of the voluntary compliance order for the area.

2.2.3 ER SH&QA Manager

The ER SH&QA Manager or designee is responsible for ensuring that ES&H oversight is provided for all ER programs and projects. This position reports to and is accountable to the ER Director. The ER SH&QA Manager performs line management review, inspections, and oversight in compliance with PRD-25, "Activity Level Hazard Identification, Analysis, and Control" and MCP-3562, "Hazard Identification, Analysis and Control of Operational Activities" (INEEL 1998c). Project or program management shall bring all ES&H/QA concerns, questions, comments, and disputes that cannot be resolved by the HSO or one of the assigned ES&H professionals to the ER SH&QA Manager or respective compliance officer.

2.2.4 CFA ES&H/QA Manager

The CFA ES&H/QA Manager or designee is responsible for ensuring that ES&H oversight is provided for all ER programs and projects performed outside of facility perimeters. This position reports to and is accountable to the CFA Site Director. The CFA ES&H/QA Manager performs line management review, inspections, and oversight in compliance with PRD-25, "Activity Level Hazard Identification, Analysis, and Control" and MCP-3562, "Hazard Identification, Analysis and Control of Operational Activities" (INEEL 1998c). Project or program management shall bring all ES&H/QA concerns, questions, comments, and disputes that cannot be resolved by the HSO or one of the assigned ES&H professionals to the ER SH&QA Manager or to the CFA ES&H/QA Manager.

2.2.5 Safety Coordinator

The assigned SC reviews work packages, periodically observes work site activity, assesses compliance with the contractor Safety and Health Manual, signs safe-work permits, advises the FTL on required safety equipment, answers questions and recommends solutions on safety issues and concerns that arise at the work site. The SC shall assist the FTL in completing the JRC. The SC may have other duties at the work site as specified in the project HASP, or in PRDs and/or MCPs. The fire protection engineer's function is included under the SC designation and is the person assigned to review work packages and perform field assessments for fire protection controls.

2.2.6 Radiological Engineer

The radiological engineer is the primary source for information and guidance relative to the evaluation and control of radioactive hazards at the work site. If a radiological hazard exists or occurs at the job site, the radiological engineer makes recommendations to minimize health and safety risks to work-site personnel. Responsibilities of the radiological engineer include

- Performing radiation exposure estimates and as-low-as-reasonably-achievable evaluations
- Identifying the type(s) of radiological monitoring equipment necessary for the work
- Advising the FTL and RCT of changes in monitoring or PPE
- Advising personnel on work-site evacuation and reentry.

The radiological engineer may have to perform evaluations specified in MCP-425, "Radiological Release Surveys and the Disposition of Contaminated Materials" (INEEL 1997d), for release of materials with inaccessible surfaces. The radiological engineer may also have other duties to perform as specified in the project HASP or in the Radiation Protection Manual.

2.2.7 Environmental Compliance Coordinator

The assigned Environmental Compliance Coordinator oversees, monitors, and advises the PM and FTL performing job site activities on environmental issues and concerns by ensuring compliance with DOE orders, EPA regulations, and other regulations concerning the effects of work site activities on the environment. The Environmental Compliance Coordinator provides support surveillance services for hazardous waste storage and transport, and surface water/storm water runoff control. The Environmental Compliance Coordinator shall assist the FTL in completing the JRC.

2.2.8 Quality Engineer

The Quality Engineer provides guidance on work-site-quality issues. The Quality Engineer observes work-site activities and verifies that work-site operations comply with quality requirements pertaining to these activities. The Quality Engineer identifies activities that do not comply or have the potential for not complying with quality requirements and suggests corrective actions.

2.2.9 Sample Management Office

The INEEL Sample Management Office (SMO) has the responsibility of obtaining necessary laboratory services as required to meet the needs of this project. The SMO will also ensure that data generated from samples meet the needs of the project by validating all analytical laboratory data to resident protocol and ensuring that data are reported to the project in a timely fashion as required by the FFA/CO. The SMO-contracted laboratory will have overall responsibility for laboratory technical quality, laboratory cost control, laboratory personnel management, and adherence to the agreed upon laboratory schedules. Responsibilities of the laboratory personnel include preparing analytical reports, ensuring CoC information is complete, and ensuring all quality assurance/quality control (QA/QC) procedures are implemented in accordance with SMO-generated task order Statements of Work and Master Task Agreements.

2.2.10 Integrated Environmental Data Management System Technical Leader

The Integrated Environmental Data Management System Technical Leader will interface with the PM during the preparation of the SAP database required by MCP-227, "Sampling and Analysis Process for Environmental Management Funded Activities" (INEEL 1997a). This individual also provides guidance on the appropriate number of field quality control samples required by the QAPjP, the appropriate bottle size and preservation for sample collection, and ensures the sample identification numbers used by the project are unique from all others ever assigned by the Integrated Environmental Data Management System. The preparation of the plan database, along with completion of the SMO request for services form, initiates the sample and sample waste tracking activities performed by the SMO.

2.2.11 Waste Generator Services

Waste Generator Service personnel provide support to the project in the area of waste segregation, storage, and disposal. For this project, a Waste Generator Service engineer will be assigned to take care of all waste generated from the tasks conducted for this project.

2.2.12 Occasional Workers

All persons who may be on the project work site, but are not part of the field team, are considered occasional site workers for the purposes of this project (e.g., surveyor, equipment operator, or other crafts personnel not assigned to the project). A person shall be considered "onsite" when they are present in or beyond the designated support zone. These individuals must meet the training requirements for occasional site workers, as identified in 29 CFR 1910.120/1926.65, "Hazardous Waste Operations and Emergency Response" and in the project HASP (INEEL 2002).

All occasional workers, including contractor and subcontractor employees who are not working on the project or nonessential representatives of DOE and/or state or federal regulatory agencies, may not proceed beyond the support zone without receiving job-specific HASP training, signing a job-specific HASP training acknowledgement form, receiving a full safety briefing, wearing the appropriate PPE, and providing proof of meeting the minimum training requirements specified in the project HASP. A fully trained job-site representative (such as the FTL, JSS, HSO, or a designated alternate) will escort nonworkers at all times while on the task site.

2.2.13 Visitors

Visitors who do not have a specific task or official business on the project are not permitted. All visitors with official business at the project task site, including contractor and subcontractor personnel and representatives of DOE and/or state or federal regulatory agencies, may not proceed beyond the support zone without receiving project-specific HASP training, signing a HASP training acknowledgment form, receiving a full safety briefing, wearing the appropriate PPE, and providing proof of meeting the minimum training requirements as specified in the project HASP. A fully trained job site representative (such as the FTL, JSS, or HSO, or a designated alternate) will escort visitors at all times while at the work site.

3. FIELD SAMPLING PLAN OBJECTIVES

This study will focus on the physical characteristics of the HI sedimentary interbed and peak concentration and distribution of groundwater COCs within the SRPA groundwater contaminant plume south of INTEC. The purpose of the study is to determine if the WAG 3 RI/FS aquifer model is correct in predicting that there will be an unacceptable risk to residential groundwater users outside the INTEC fence line in excess of $1 \times 10\text{-}4$, or that COCs within the aquifer may exceed the maximum contaminant levels (MCLs) in the year 2095 and beyond. The potential risk is primarily from I-129, which is predicted by the aquifer model to reside in the HI interbed at concentrations exceeding the remediation goal. The objective of this FSP is to clearly outline the rational and methods for collecting samples to evaluate this potential risk. This FSP is also designed to guide the collection of data in order to address the decision statements specified in Section 3.1.2.3.

A separate monitoring plan will detail the continued collection and evaluation of data collected from these wells under a long term monitoring program.

3.1 Data Quality Objectives

The EPA developed the Data Quality Objective (DQO) process as a means to "improve the effectiveness, efficiency, and defensibility of decisions" (EPA 1994) used in the development of data collection designs. The DQO process is a systematic procedure for defining data collection criteria based on the scientific method. This process consists of seven iterative steps that yield a set of principal study questions and decision statements that must be answered to address a primary problem statement. The seven steps comprising the DQO process are listed below:

Step 1: State the problem

Step 2: Identify the decision

Step 3: Identify the inputs to the decision

Step 4: Define the study boundaries

Step 5: Develop decision rules

Step 6: Specify limits on the decision

Step 7: Optimize the design for obtaining data.

The following sections present details on each of the DQO steps to be answered by the work conducted under this FSP. A summary of the HI interbed evaluation DQOs is presented in Table 3-1.

Table 3-1. Data Quality Objectives table, OU 3-13, Group 5, Snake River Plain Aquifer.

Problem Statement A: HI Interbed Contingent Remedy Decision					
1: State the Problem	2: Identify the Decision			3: Identify Inputs to the Decision	4. Define the Study Boundaries
	Principal Study Questions	Alternative Actions	Decision Statement		
Problem Statement A: Empirical data are required to support evaluation of the WAG 3 Snake River Plain aquifer numerical model to determine if we continue to predict a risk to future groundwater users in 2095 and beyond due to I-129 potentially present in the HI sedimentary interbed. Note: Modeling of the SRPA for the WAG 3 RI/FS predicted a future risk to groundwater users due to high concentrations of I-129 predicted to be present in the low-hydraulic conductivity HI sedimentary interbed in the year 2095 and beyond. However, no empirical data are available to confirm the physical properties of the HI interbed as assumed in the WAG 3 model nor are there any data regarding the presence or absence of high concentrations of I-129 in the interbed. Empirical evidence is required to evaluate the model predictions and determine whether or not an acceptable risk from I-129 is predicted to exist in 2095 and beyond.	PSQ-1: Are COC concentration action levels exceeded in the model-predicted hot spot of the groundwater contaminant plume outside of the INTEC security fence? Note: The action level(s) is based on groundwater modeling and will correspond to COC concentrations that will not exceed risk concentrations greater than 1×10^{-4} or MCLs in the year 2095. COC concentration data will be obtained from the HI interbed and surrounding basalts during the field sampling program anticipated to occur in FY 2001. Modeling predictions are required to determine if these action levels will be exceeded in 2095. The combined COC action level for H-3, Sr-90, and I-129 (beta – gamma-emitters) is 4 mrem/yr in the year 2095.	AA-1: Alternatives to PSQ-1 include proceeding on to actions required to answer PSQ-3 or lapsing into SRPA monitoring.	DS-1: Determine whether COC concentration action levels are exceeded in the model-predicted hot spot downgradient of INTEC requiring additional evaluation of the aquifer water yield from the hot spot.	The following are inputs to PSQ-1: 1. Groundwater model sensitivity analysis of the HI sedimentary interbed characteristics to identify key variables related to HI interbed for long-term predictions of COC concentrations 2. Establishing four new wells/boreholes in the I-129 hot spots for groundwater and sedimentary interbed sampling 3. Physical characteristics of the HI sedimentary interbed (TBD, will be identified in the aquifer model sensitivity analysis) to support model refinement and COC concentration predictions 4. Borehole geophysical and fluid logging of new wells for location of sampling depths 5. Vertical profile sampling (straddle packer) of new wells/boreholes and existing wells for COC concentrations at, above, and below the HI interbed 6. One sampling round of 47-aquifer monitoring wells for I-129, H-3, and Sr-90 to support model refinement and COC concentration predictions 7. Model refinement and updated prediction of COC concentrations in 2095 and beyond.	This study will focus on physical characteristics of the HI sedimentary interbed and peak concentrations and distribution of groundwater COCs within the SRPA groundwater contaminant plume south of INTEC. The purpose of the study is to determine if the WAG 3 RI/FS aquifer model is correct in predicting that there will be an unacceptable risk to residential groundwater users outside of the INTEC fence line in excess of 1×10^{-4} (or COCs exceeding MCLs) in the year 2095 and beyond. The potential risk is primarily from I-129, which is predicted by the aquifer model to reside in the HI interbed at concentrations exceeding the remediation goal. The spatial boundary of this study is limited to the area defined as Group 5, SRPA, under the OU 3-13 ROD. This encompasses that portion of the SRPA outside of the INTEC security fence bounded by the groundwater contaminant plume that exceeds Idaho groundwater quality standards of the federal MCLs for I-129, H-3, or Sr-90. Based upon the WAG 3 groundwater model, the area of particular interest within this boundary is an I-129 hot spot south of INTEC in the vicinity of well USGS-113 (note: this may be refined by prefield testing sensitivity analysis of HI interbed in the WAG 3 aquifer model). The estimated depth of the HI interbed in this area is between 100 and 140 ft below the water table, though the aquifer above, within, and below the HI interbed is included in this study. The base of the study area will be the first high permeability zone in the I basalt below the HI interbed, but not to exceed 100 ft below base of HI interbed. The hot spot is predicted to exist within the HI sedimentary interbed below the water table at this location. However, to date, empirical evidence has not been collected that supports the existence of this hot spot, nor has a sensitivity analysis been performed on the WAG 3 model's representation of the HI interbed that resulted in the prediction. It should be noted that practical constrains on the collection of soil and groundwater samples (i.e. poor sample recovery, limitation on packer deployment in rubbley or cavernous zones, etc.) may limit our ability to sample the interbed or SRPA in general at certain zones. This study will be used to determine if contingent groundwater remediation is required to reduce the risk to future groundwater users in the year 2095 and beyond. Thus the current decision of whether or not to implement the contingent remedy will rely on predicted concentrations of COCs as calculated by the refined WAG 3 aquifer model. Prior to 2095, institutional controls will be in place to prevent residential use of groundwater exceeding MCLs or 1×10^{-4} risk concentrations.
	PSQ-2: Do zones which exceed COC action levels identified in PSQ-1 yield a sustained flow of greater than 0.5 gpm for a period of 24 hours?	AA-2: Alternatives to PSQ-2 included proceeding to actions required to answer PSQ-3 or lapsing into SRPA monitoring.	DS-2: Determine if the hot spot will yield a groundwater flow rate of 0.5 gpm for a period of 24 hours.	If the COC action levels are exceeded in PSQ-1, then the following will be inputs to PSQ-2: 1. A 24 hour/0.5 gpm pumping test(s) of the zones which were identified in PSQ-1 as having COC(s) which exceeded action level(s) 2. Sampling of the COC(s) during the pumping test.	
	PSQ-3: Does the hot spot exceed the volume-action level such that a residential water user may pump from the hot spot for a period of more than one year?	AA-3: Alternatives to PSQ-3 include proceeding on to the contingent remedy and aquifer monitoring or just lapsing into SRPA monitoring.	DS-3: Determine if the hot spot is of sufficient size/volume to require contingent remediation.	If required, the following will be inputs to PSQ-3: 1. An analytical or model-derived volume action level 2. Evaluation of the COC hot spot volume through the creation of iso-surface maps to calculate the estimated volume.	

Table 3-1. (continued).

Problem Statement A: HI Interbed Contingent Remedy Decision		
5: Develop a Decision Rule	**6: Specify Tolerable Limits on Decision Errors**	**7: Optimize the Design**
DS-1: If any COC exceeds its action level at any sampling zone then we must determine if the aquifer at that zone is also capable of producing a sustained yield of 0.5 gpm for a period of 24 hours. If COC action levels are not exceeded at any sampling location then we will proceed with SRPA monitoring (i.e. periodic monitoring).	To be determined.	A flow chart presenting the conceptual design of the WAG 3 Group 5 field activities is attached as Figure 1-1 titled "Group 5 Snake River Plain Aquifer Flow Chart." The flow chart details the steps to be taken to both arrive at a contingent remedy decision and to perform the SRPA interim monitoring. The two separate flow paths are identified on the chart. The following paragraphs describe and present the rationale for the design of field activities related to the contingent remedy decision. The Group 5 decision to collect additional COC concentration and SRPA and interbed data prior to making a decision on implementation of the contingent remedy is based upon the need to evaluate the WAG 3 RI/FS model predictions of elevated I-129 concentrations in the SRPA, including the HI interbed, in 2095 and beyond. Because no physical characteristics or COC concentration data were available from the HI interbed to confirm the model predictions, and no sensitivity analysis has been performed, we must collect empirical data on the presence of I-129 in the SRPA and physical properties of the HI interbed south of INTEC to support refinement of the groundwater model. Given the basis for the field activities, prior to conducting the field activities, available field data will be reviewed and a sensitivity analysis on the HI interbed assumptions will be performed. This activity will be performed to identify hydrologic data gaps which will be incorporated in the final sampling and analysis plan for the Group 5 contingent remedy decision.
DS-2: If the aquifer is capable of producing 0.5 gpm for a period of 24 hours from a zone which also exceeds COC action levels, then we must determine the volume of the hot spot. If the zone does not produce 0.5 gpm for 24 hours then we will proceed with SRPA monitoring.		Based upon the RI/FS hot spot modeling and the MSIP hot spot modeling, four additional wells/boreholes will be constructed. The wells will be drilled in a manner that allows for the collection of sedimentary interbed samples from the HI interbed for analysis of physical characteristics and COC concentrations. Following drilling, borehole geophysical and fluid logging will be performed on the newly deepened and constructed wells (and three existing wells selected for profiling) to identify sampling locations for COC vertical profile sampling. The geophysical logging will consist of natural gamma, caliper, deviation, and video logging. Borehole fluid logging will consist of borehole flow, temperature, and specific conductivity. These logs will be reviewed prior to groundwater sample collection to identify the specific zones within each borehole for sampling. Groundwater sampling will be conducted using a packer system and sampling pump to isolate the specific zone being sampled. Except for the interbed sample, one sample will be collected from each sampling zone. Because of concerns about borehole collapse or sloughing in the interbed, groundwater samples from the interbed will be collected during drilling. The borehole will be extended approximately five feet into the interbed and the first sample will be taken using a single packer system and will consist of packing off the basalt at the interbed basalt interface. A bottom packer will not be used for interbed sampling. To guard against equipment getting trapped in the hole, the pump will be placed above the packer and a screen placed below the packer in the interbed. Replicate samples for Tc-99 and I-129 will be collected during interbed sampling. The replicate Tc-99 samples will be analyzed and the replicate I-129 sample held in storage until the results are determined for the I-129 and Tc-99 samples. The replicate samples will be analyzed for Tc-99 to confirm the original sample results. If I-129 is above the action level, the replicate I-129 sample from the interbed will be analyzed.
DS-3: If the volume of the COC hot spot is sufficiently large that a future groundwater user could pump from the hot spot for a period of more than one year, then we are required to proceed with the contingent remedy. If the hot spot does not exceed the volume action level, then we will proceed with SRPA monitoring.		Following sample collection and analysis, the data will be reviewed to determine if the COC action levels are exceeded in any sampling zone. If the COC action level is exceeded in a zone, the zone will again be isolated with packers and pumped for a period of 24 hours to determine if the zone will yield groundwater at a rate of 0.5 gpm for the duration of the test. One water sample will be collected every 4 hours during pumping to determine if the COC action levels are also exceeded through out the pumping test. If COC action levels are exceeded and the aquifer at the sampling zone(s) yields a sustained 0.5 gpm for a 24-hr period, isopleth maps will be developed from the COC concentration data to estimate the volume of the hot spot(s). It is possible that additional wells may be required to estimate the hot spot volume. If additional wells are determined necessary, they will be drilled and then tested in the same manner as described above. The final volume estimates will be compared to the model derived volume action level to determine if it has been exceeded. These results will be reported in the Group 5 monitoring report/decision summary. To assist in the model evaluation and COC predictions discussed above, and to up date information on COC plume dynamics subsequent to the 1991 USGS sampling event, samples will be collected from the existing aquifer monitoring well network and analyzed for COC concentrations. This sampling will provide additional data to support model predictions of how the aquifer is performing outside of the HI interbed and support refining of the model predictions. A first round of sampling will be performed including the full INTEC monitoring network (47 wells), with subsequent annual monitoring performed on a limited set of wells (approximately 20) specifically identified to support an updated aquifer model calibration. Following completion of the monitoring report/decision summary, periodic monitoring of the WAG 3 groundwater plume(s) outside of the INTEC security fence line will be implemented. This periodic monitoring of the plumes will be performed concurrent with the INTEC facility monitoring.

3.1.1 State the Problem

The WAG 3 ROD (ROD Section 8, page 8-3) established a remedial action objective for the SRPA as follows: "In 2095 and beyond, (to) ensure that SRPA groundwater does not exceed a cumulative carcinogenic risk of 1×10^{-4}, a total, hazard index of 1; or applicable State of Idaho groundwater quality standards (i.e., MCLs)" (DOE-ID 1999). Group 5 of WAG 3 is defined as that portion of the SRPA outside of the current INTEC fence line bounded by the contaminant plume that currently exceeds Idaho groundwater quality standards or the federal MCLs for I-129, H-3, and Sr-90. Based upon the above remedial action objective for groundwater, a remediation goal for Group 5 was also established in the ROD (ROD Section 8.1.5, pages 8–10). The remediation goal is to achieve the applicable State of Idaho groundwater standards or risk-based groundwater concentrations in the SRPA plume south of the INTEC security fence by the year 2095.

The ROD also establishes the means of achieving this goal through a phased approach. The first phase would determine if model-derived action levels for COCs are exceeded. The second phase occurs if the action levels are exceeded. In that case, a contingent pumping and treatment action will be implemented to remove sufficient contaminants to facilitate aquifer restoration by 2095 (ROD, Section 8.1.5, pages 8–10). This drilling program is required to determine if current groundwater concentrations for COCs exceed the modeled action levels and, if they do, can sufficient volume and production rates be achieved by a residential water supply well that would pose a risk to the future groundwater user in the year 2095 and beyond.

Data collected from the drilling program may also benefit in the calibration and validation of the present groundwater contaminant predictive model. The model indicates that the principal risk to future groundwater users in the SRPA outside the INTEC facility boundary is the I-129 concentrations in the SRPA (ROD Table 7-8, pages 7–26). From the WAG 3 Feasibility Study Supplement (DOE-ID 1998) modeling, peak concentrations of I-129 are predicted to remain above MCLs after 2095 in the HI sedimentary interbed while water in the bulk of the aquifer will be below the I-129 MCLs by 2095. However, no data are available to confirm the physical properties of the HI interbed as assumed in the WAG 3 model nor is there any data regarding the presence or absence of high concentrations of I-129 in the interbed. Data are required to refine the model predictions and determine whether or not an acceptable risk from I-129 is predicted to exist in 2095 and beyond.

3.1.2 Identify the Decisions

This step lays out the principal study questions, alternative actions (AA), and corresponding decision statements that must be answered to effectively address the above stated problem.

3.1.2.1 Principal Study Questions. The purpose of the principal study question (PSQ) is to identify key unknown conditions or unresolved issues that, when answered, provide a solution to the problem being investigated, as stated above. The PSQs for this project are as follows:

PSQ-1: Are COC concentration action levels exceeded in the model-predicted hot spot of the groundwater contaminant plume located to the south of the INTEC facility security fence, and do COCs exceed the concentration action levels anywhere vertically within the groundwater contaminant plume located to the south of the INTEC security fence?

PSQ-2: Do any zones that exceed COC action levels identified in PSQ-1 yield a sustained flow of greater than 0.5 gpm for a period of 24 hours?

PSQ-3: Does the hot spot exceed the volume action level such that a residential water user may pump from the hot spot for a period of more than one year?

3.1.2.2 *Alternative Actions.* AAs are those actions that could possibly result from the resolution of the above PSQs. The types of AAs considered will depend on the answers to the PSQs.

AA-1: Based on data indicating the degree of contamination, the alternatives to PSQ-l include proceeding to actions required to define PSQ-2 or to proceed with periodic monitoring.

AA-2: Based on data collected during a 24-hour pumping test, the alternatives to PSQ-2 include proceeding to actions required to define PSQ-3 or to proceed with periodic monitoring.

AA-3: Based on volume determinations, the alternatives to PSQ-3 include proceeding to contingent remediation or proceeding with periodic monitoring.

3.1.2.3 *Decision Statements.* The decision statements (DS) combine the PSQ and AA into a concise statement of action. The DS for each of the PSQs are stated below:

DS-1: Determine whether COC concentration action levels are exceeded in the model-predicted hot spot downgradient of INTEC, requiring additional evaluation of the aquifer water yield from the hot spot.

DS-2: Determine if the hot spot will yield a groundwater flow rate of 0.5 gpm for a period of 24 hours, requiring additional evaluation of the aquifer water hot spot volume.

DS-3: Determine if the hot spot is of sufficient size/volume to require contingent remediation. This step identifies the informational inputs that are required to answer the DS made above.

3.1.2.4 *Inputs for PSQ-1.*

1. Groundwater model sensitivity analysis of the HI sedimentary interbed characteristics to identify key variables related to HI interbed for long-term predictions of COC concentrations.

2. Four additional wells/boreholes will be installed in the vicinities of the RI/FS I-129 hot spot modeling and the MSIP I-129 hot spot modeling for groundwater and sedimentary interbed sampling.

3. Physical characteristics of the HI sedimentary interbed (saturated hydraulic conductivity, bulk density, grain size, distribution, and porosity estimate) will be identified in the aquifer model sensitivity analysis to support model refinement and COC concentration predictions.

4. Borehole geophysical and fluid logging of the new wells and three existing wells for location of sampling depths.

5. Vertical profile sampling (straddle packer) of the four deepened wells, one new well, and three existing wells for I-129, H-3, and Sr-90 concentrations at, above, and below the HI interbed.

6. Model refinement and updated prediction of COC concentrations in 2095 and beyond.

3.1.2.5 *Inputs for PSQ-2.* If the COC action levels are exceeded in PSQ-1, then a pumping test will be conducted to determine if the hot spot zone will yield groundwater at a rate of 0.5 gpm for a period of 24 hours. The zone of highest concentrations as determined by sampling performed for PSQ-1 will be pump tested for a 24-hour period. During the pumping test, discharge water will be sampled to determine if COC concentrations exceed the action level throughout the pumping period. Thus, the inputs for PSQ-2 are

1. A 24-hour/0.5 gpm pumping test(s) of the zones that were identified in PSQ-1 as having COC(s) that exceeded action level(s)

2. Sampling of the discharge water for COC(s) during the pumping test.

3.1.2.6 Inputs for PSQ-3. If the results of studies performed for PSQ-1 and PSQ-2 indicate that further action is necessary, PSQ-3 will be implemented to determine what the volume of the hot spot(s) is and whether the volume of the hot spot will sustain pumping for a period of one year. The volume action level will need to be determined based upon either analytical or numerical modeling techniques. Three dimensional isopleth maps will be prepared from this information to estimate the volume of the hot spot that exceeds the COC action levels. Therefore, if required, the inputs to PSQ-3 will be

1. An analytical or model-derived volume action level

2. Evaluation of the COC hot spot volume through the creation of iso-surface maps to calculate the estimated volume.

3.1.3 Define the Boundaries of the Study

This study will focus on physical characteristics of the HI sedimentary interbed and peak concentrations and distribution of groundwater COCs within the SRPA groundwater contaminant plume south of INTEC. The purpose of the study is to determine if the WAG 3 RI/FS aquifer model is correct in predicting that there will be an unacceptable risk to residential groundwater users outside the INTEC fence line in excess of 1×10^{-4} or COCs exceeding MCLs in the year 2095 and beyond. The potential risk is primarily from I-129, which is predicted by the aquifer model to reside in the HI interbed at concentrations exceeding the remediation goal.

The spatial boundary of this study is limited to the area defined as Group 5, SRPA, under the OU 3-13 ROD. This encompasses that portion of the SRPA outside the INTEC security fence bounded by the groundwater contaminant plume that exceeds Idaho groundwater quality standards, the federal MCLs for I-129, H-3, or Sr-90. Based upon the WAG 3 groundwater model, the area of particular interest within this boundary is an I-129 hot spot south of INTEC in the vicinity of USGS-113 Well. An additional area of interest lies further south near the CFA landfill wells (LF2 and LF3 series) where MSIP modeling indicates elevated I-129 concentrations. The estimated depth of the HI interbed in this area is between 30 to 43 m (100 and 140 ft) below the water table, though the aquifer above, within, and below the HI interbed is included in this study. The base of the study area will be the first high permeability zone in the I basalt below the HI interbed, but not to exceed 30 m (100 ft) below the base of the HI interbed. The hot spot is predicted to exist within the HI sedimentary interbed below the water table at this location. However, to date, empirical evidence has not been collected that supports the existence of this hot spot, nor has a sensitivity analysis been performed on the WAG 3 model of the HI interbed that resulted in the prediction.

It should be noted that practical constraints on the collection of soil and groundwater samples (i.e., poor sample recovery, limitations on packer deployment in highly fractured or cavernous zones, etc.) may limit our ability to sample the interbed or SRPA at certain zones. This study will be used to determine if contingent groundwater remediation is required to reduce the risk to future groundwater users in the year 2095 and beyond. Thus, the current decision of whether or not to implement the contingent remedy will rely on predicted concentrations of COCs as calculated by the refined WAG 3 aquifer model.

Prior to 2095, institutional controls will be in place to prevent residential use of groundwater exceeding MCLs or 1×10^{-4} risk concentrations.

3.1.4 Develop a Decision Rule

This step brings together the outputs from Steps 1 through 4 into a single statement describing the basis for choosing among the listed alternatives. The decision rules guiding this investigation are basically set forth in Figure 11-6, on page 11-24 of the WAG 3 ROD (DOE-ID 1999). Three criteria must be met prior to a positive decision to implement contingent remediation:

Decision Rule (DR)-l: If any COC exceeds its action level at any sampling zone, then we must determine if the aquifer at that zone is also capable of producing a sustained yield of 0.5 gpm for a period of 24 hours. If COC action levels are not exceeded at any sampling location, then we will proceed with SRPA monitoring (i.e., periodic monitoring).

DR-2: If the aquifer is capable of producing 0.5 gpm for a period of 24 hours from a zone that also exceeds COC action levels, then we must determine the volume of the hot spot. If the zone does not produce 0.5 gpm for 24 hours, then we will proceed with SRPA monitoring.

DR-3: If the volume of the COC hot spot is sufficiently large, such that a future groundwater user could pump from the hot spot for a period of more than one year, then we are required to proceed with the contingent remedy. If the hot spot does not exceed the volume action level, then we will proceed with SRPA long-term monitoring.

3.1.5 Specify Tolerable Limits on Decision Errors

Five types of new information may be collected or developed during this study: (1) laboratory analytical data from groundwater samples, (2) borehole geophysical logs, (3) aquifer testing results, (4) groundwater numerical modeling results, and (5) sedimentary interbed physical characterization (i.e., saturated hydraulic conductivity, bulk density, grain size, and porosity). Because of the nature of logging and aquifer testing studies, statistically-based decision error limits are not applicable and not required. Modeling information derived from the analytical data will not be directly amenable to statistical evaluation. Standard modeling error evaluation will be utilized to review the modeling results.

Laboratory analytical data collected during this study to determine if an action level is exceeded are amenable to statistically based limits on decision errors. Hypothesis testing will be utilized to determine if an action level is exceeded at any sampling point to resolve PSQ-1. The recommended null hypothesis, H_0, is that the true mean groundwater concentration for each COC is greater than or equal to the action level. The alternative hypothesis is that the mean is less that the action level:

H_0: $\mu \geq$Action Level

H_a: $\mu <$ Action Level.

This hypothesis testing will be based upon small sample statistics (n<30; where n is the total number of measurements) and utilize the t-test statistic:

$$\text{Test Statistic: } t = \frac{\bar{x} - hypothesized\,value}{s / \sqrt{n}}.$$

Using this test statistic and hypothesis, we would reject the null hypothesis (and thereby accept the alternative hypothesis) if the test statistic t is less than the negative value of the t critical value obtained from standard math tables, given our number of samples and desired level of significance. This hypothesis testing will be performed to a level of significant, or α, of 0.05. In other words, with this level of significance and null hypothesis, we limit the probability of a Type 1 error, or of rejecting the null hypothesis when it is in fact true, to only 5%. The proposed hypothesis testing is designed to allow us to control the probability of erroneously concluding that COC action levels are not exceeded when in fact they are exceeded. This null hypothesis was formulated based upon our belief that the harmful consequences of incorrectly concluding that an action level is not exceeded, when it actually is, is greater than the consequences of incorrectly concluding that the action level is exceeded when in fact it is not.

3.1.6 Optimize the Design

A project flow chart, presenting the conceptual design of the WAG 3 Group 5 field activities, is shown in Figure 1-1. The flow chart details the steps to be taken to both arrive at a contingent remedy decision and to perform the SRPA interim monitoring. The two separate flow paths are identified on the chart. The following paragraphs describe and present the rationale for the design of field activities related to the contingent remedy decision. The Group 5 decision to collect additional COC concentration and SRPA and interbed data prior to making a decision on implementation of the contingent remedy is based upon the need to evaluate the WAG 3 RI/FS model predictions of elevated I-129 concentrations in the SRPA, including the HI interbed, in 2095 and beyond. Because no physical characteristics or COC concentration data were available from the HI interbed to confirm the model predictions and no sensitivity analysis has been performed, we must collect empirical data on the presence of I-129 in the SRPA and physical properties of the HI interbed south of INTEC to support refinement of the groundwater model.

Given the basis for the field activities, prior to conducting these activities, available field data were reviewed and a sensitivity analysis on the HI interbed assumptions was performed. This review and analysis was performed to identify hydrologic data gaps. The model sensitivity analysis is presented in Appendix C.

Based upon evaluation of the RI/FS modeling results, model sensitivity analysis, and existing data, four additional wells/boreholes will be constructed and three existing wells which already penetrate the HI interbed will be sampled.

The wells will be drilled in a manner that allows for the collection of sedimentary samples from the HI interbed for analysis of physical characteristics and COC concentrations. Following drilling, borehole geophysical and fluid logging will be performed on the new wells (and any previously existing wells selected for profiling) to identify sampling locations for COC vertical profile sampling. The geophysical logging will consist of natural gamma, caliper, deviation, and video logging. Borehole fluid logging will consist of borehole flow, temperature, and specific conductivity. These logs will be reviewed prior to groundwater sample collection to identify the specific zones within each borehole for sampling.

Groundwater sampling will be conducted using a packer system and sampling pump to isolate the specific zone being sampled. Except for the interbed sample, one sample will be collected from each sampling zone. Because of concerns about borehole collapse or sloughing in the interbed, water samples from the interbed will be sampled on the way down during drilling. The borehole will be extended approximately five feet into the interbed and the first sample will be taken using a single packer system and will consist of packing off the basalt at the interbed basalt interface. A bottom packer will not be used for interbed sampling. To guard against equipment getting trapped in the hole, the pump will be placed above the packer and a screen placed below the packer in the interbed. Replicate samples for Tc-99 and I-129 will be collected during interbed sampling. The replicate Tc-99 samples will be analyzed and the replicate I-129 sample held in storage until the results are determined for the I-129 and Tc-99 samples. The replicate samples collected from the interbed will be analyzed for Tc-99 to confirm the original sample results. If I-129 is above the action level, the replicate I-129 sample from the interbed will be analyzed. An aquifer stress test (i.e., a slug test) will also be performed at the time of sampling.

Following sample collection and analysis, the data will be reviewed to determine if the COC action levels are exceeded in any sampling zone. If the COC action level is exceeded in a zone, the zone will again be isolated with packers and pumped for a period of 24 hours to determine if the zone will yield groundwater at a rate of 0.5 gpm for the duration of the test. One water sample will be collected every 4 hours during pumping to determine if the COC action levels are also exceeded throughout the pumping test.

If COC action levels are exceeded and the aquifer at the sampling zone(s) yields a sustained 0.5 gpm for a 24-hour period, isopleth maps will be developed from the COC concentration data to estimate the volume of the hot spot(s). It is possible that additional wells may be required to estimate the hot spot volume. If additional wells are determined necessary, they will be drilled and then tested in the same manner as described above. The final volume estimates will be compared to the model derived volume action level to determine if it has been exceeded. These results will be reported in the Group 5 monitoring report/decision summary.

Long-term monitoring of the aquifer within and downgradient of the INTEC facility will be conducted as described in the MSIP.

3.2 Sampling Objectives

Sampling objectives have been determined through the careful evaluation of existing data and application of the DQO process. This process has lead to the development of data requirements needed to define the nature and extent of contaminants, contaminant source estimation, fate and transport evaluation, and modeling. The primary purpose for sampling the SRPA wells is to define contaminant source potential of the HI-interbed and aquifer hot spots south of the INTEC facility in order to more accurately access the impacts to water quality in 2095 and beyond. Samples will be collected from existing wells and from wells constructed specifically for this sampling.

4. FIELD ACTIVITIES

The following sections describe the field activities and procedures to be used to meet the DQOs described in Section 3. Prior to commencing any sampling activities, a prejob briefing will be held with all work-site personnel to review the requirements of the FSP, HASP, and other work-control documentation and to verify that all supporting documentation has been completed. Additionally, at the termination of the drilling and at the end of sampling, a postjob review will be conducted. Both prejob briefings and postjob reviews will be conducted in accordance with MCP-3003, "Performing Prejob Briefings and Postjob Reviews."

The OU 3-13, Group 5, SRPA plume evaluation project activities will include the coring of boreholes, collection of deep sedimentary interbed samples for geotechnical analysis, lithologic and geophysical logging of coreholes, collection of aquifer water samples, and pump-testing zones for conductivity data requirements.

4.1 Sampling and Monitoring Well Locations

Several SRPA monitoring wells, shown in Figure 4-1, are located south of the INTEC facility in and around the modeled I-129 plume. USGS Wells 38, 57, and 67 are completed below the HI interbed stratigraphic unit and can be used for the collection of aquifer water samples to bound the contaminant plume above, within, and below the HI interbed. The wells selected solely for sampling are shown in Figure 4-1.

Presently, there are no wells inside the hot spots that penetrate to or through the HI interbed. The criterion for placement of the new wells will be based upon the RI/FS I-129 hot spot modeling and the MSIP I-129 hot spot modeling. To address the project DQOs, it is necessary to collect data in interbed geophysical parameters, the HI interbed thickness, aquifer water COC concentrations, and aquifer hydraulic conductivity. To collect this data, four additional wells/boreholes will be installed by coring through the HI interbed to the first zone of high permeability in the I basalt flow ('I' is the nomenclature for basalt flow located beneath the HI interbed stratigraphic unit) (Anderson 1991) below the HI interbed, but not to exceed 30 m (100 ft) below the interbed base.

The HI interbed is a sedimentary unit located stratigraphically between the H and I basalt flow groups. The interbed is approximately 183 m (600 ft) below land surface and generally slopes to the southeast. The average thickness of the unit within the study area is approximately 6 m (20 ft), but thickness ranges from 0 to 18 m (0 to 60 ft) have been observed in nearby wells. Stratigraphic data, including the estimated elevation of the HI interbed upper surface, the depth of the HI interbed below the top of the SRPA, and the HI interbed estimated thickness are shown in Figures 4-2, 4-3, and 4-4.

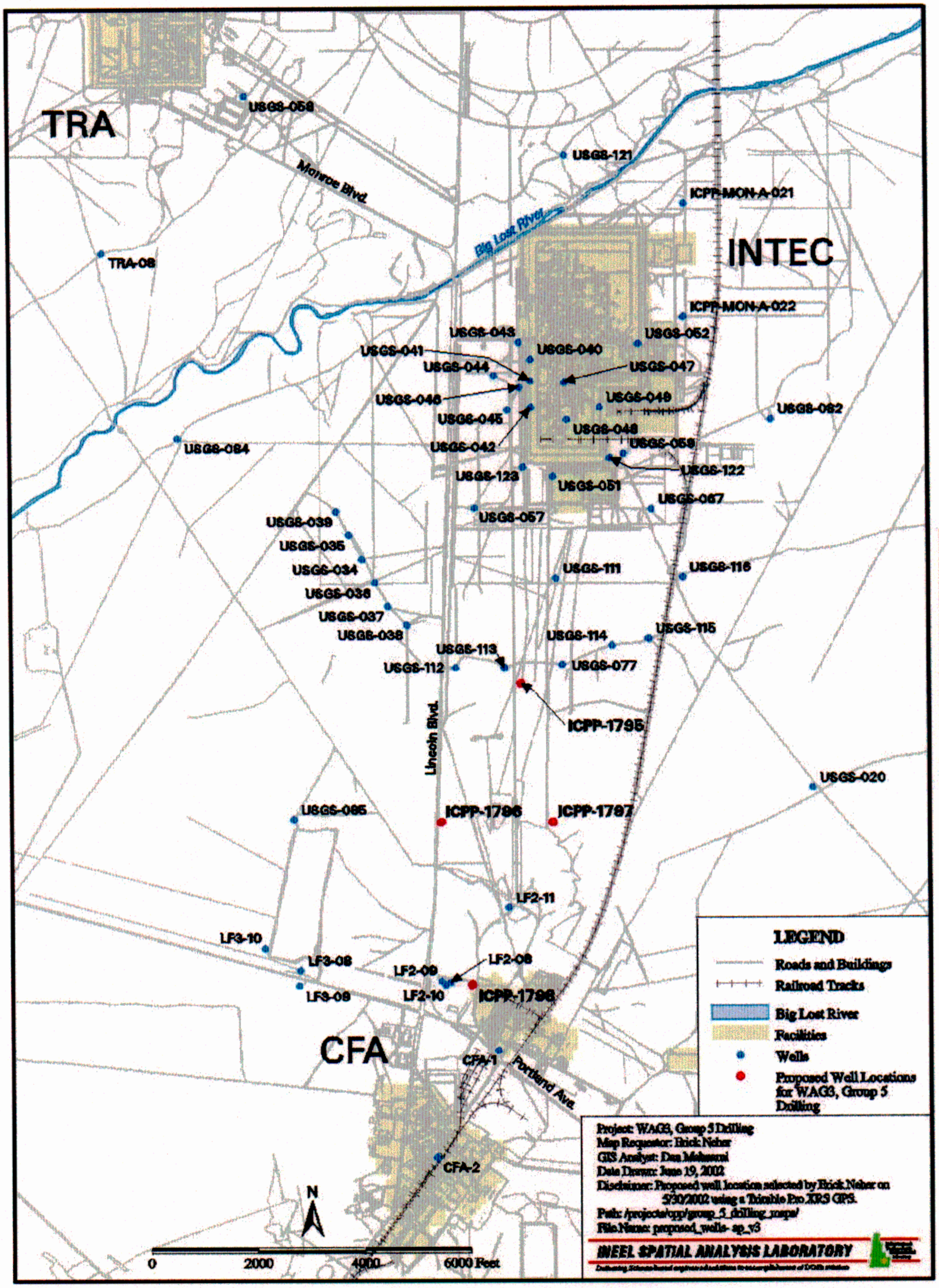


Figure 4-1. Location of monitoring wells to be deepened to sample HI interbed and location of New Well.

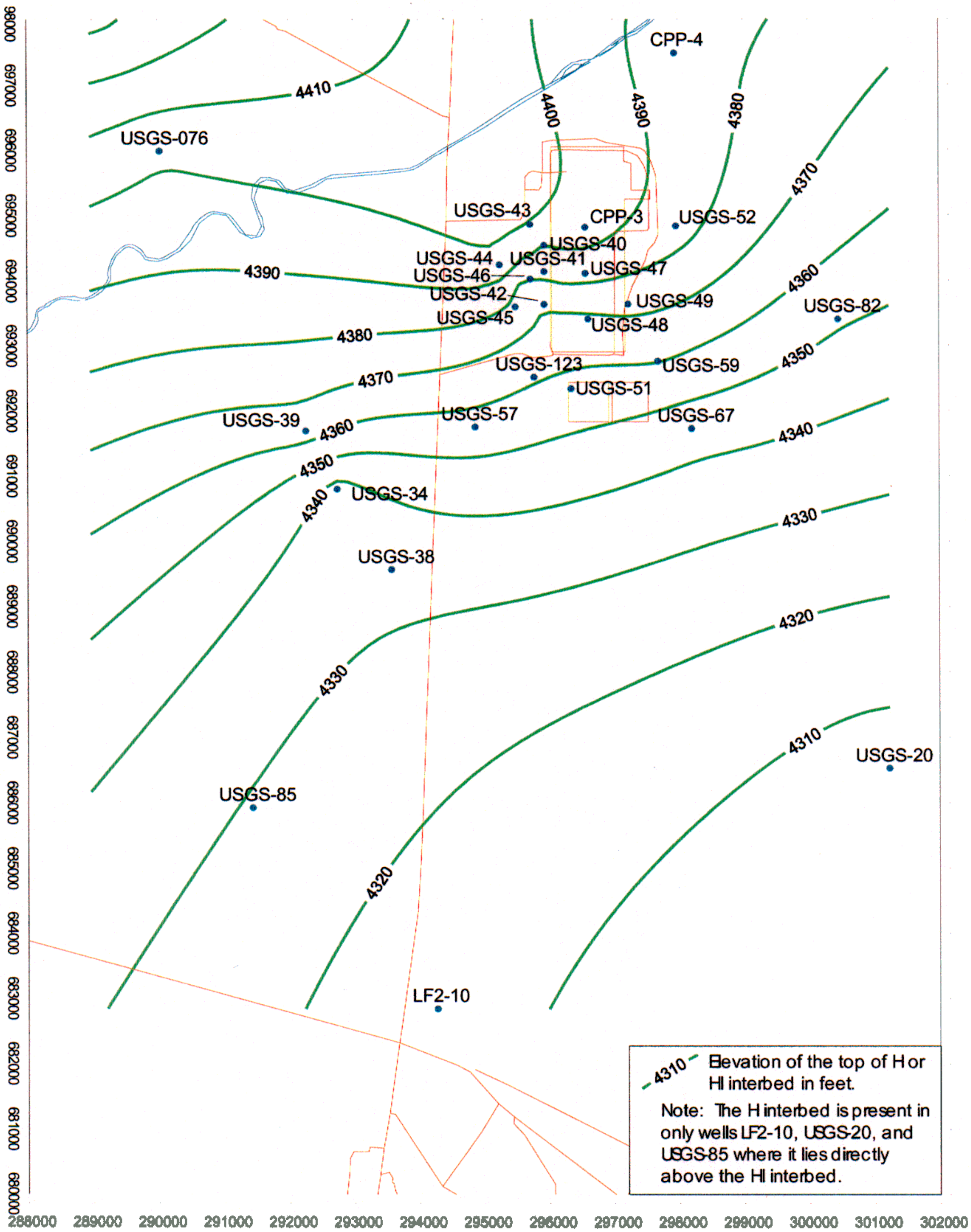


Figure 4-2. Elevation of the top of the H and HI interbeds.

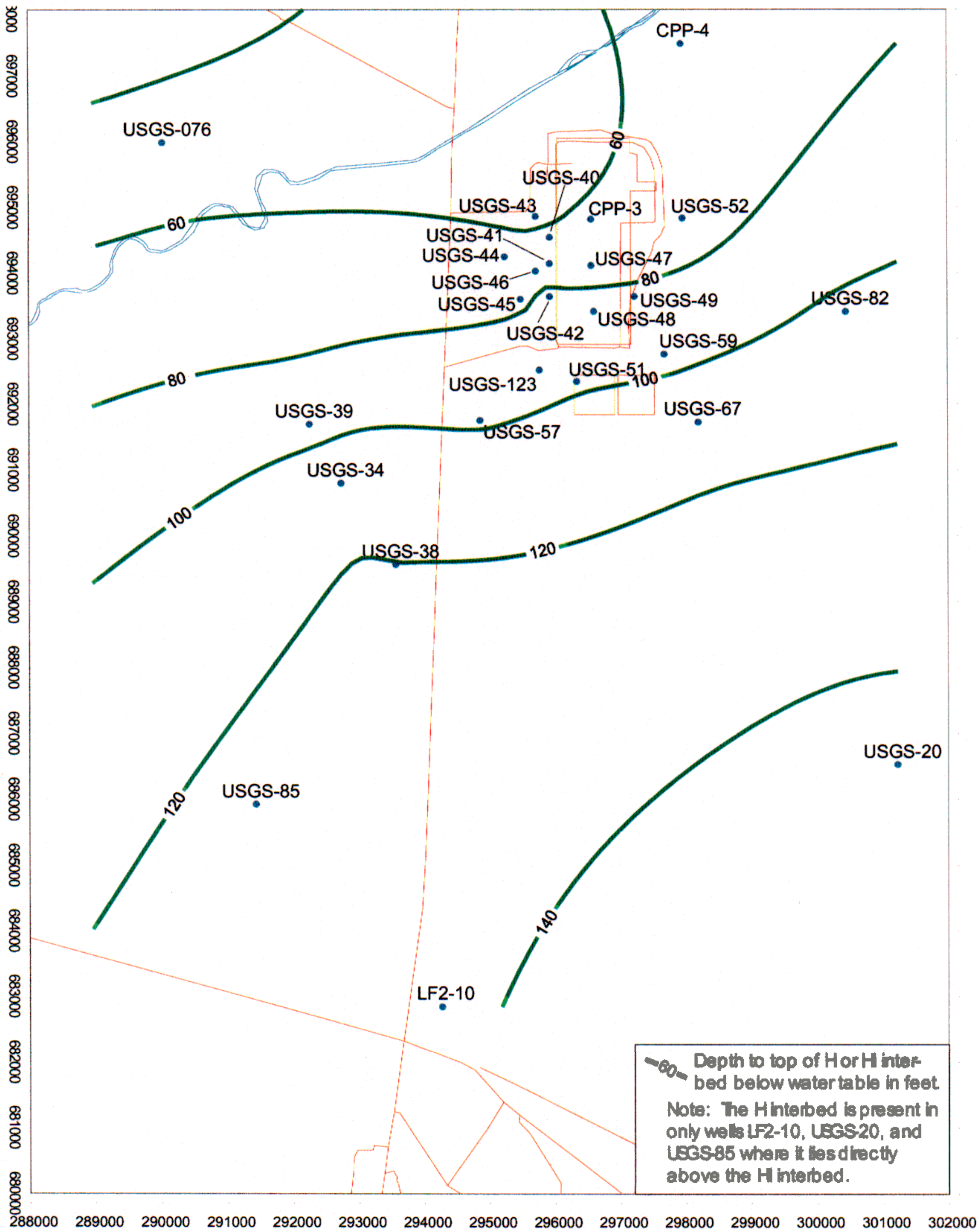
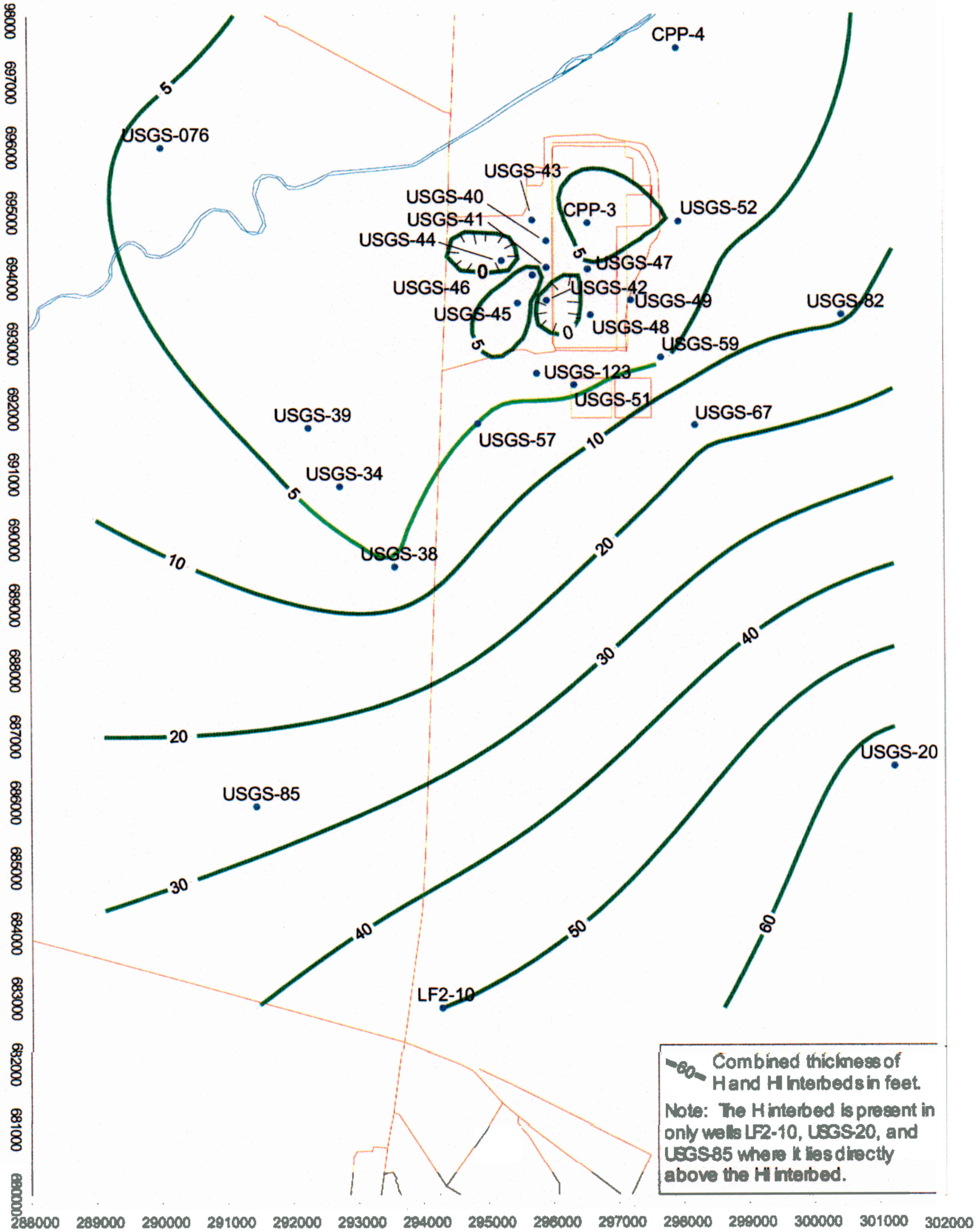


Figure 4-3. Depth of H – HI interbed below water table.


CPP-4
USGS-076
USGS-43
USGS-40
USGS-41
USGS-44
CPP-3
USGS-52
USGS-47
USGS-46
USGS-42
USGS-49
USGS-82
USGS-45
USGS-48
USGS-59
USGS-123
USGS-51
USGS-39
USGS-57
USGS-67
USGS-34
USGS-38
USGS-20
USGS-85
LF2-10
Combined thickness of H and HI interbeds in feet.
Note: The H interbed is present in only wells LF2-10, USGS-20, and USGS-85 where it lies directly above the HI interbed.

4.2 Well Drilling

This section details the methods used for drilling, sampling, and lithological logging of each well. The drilling will be conducted by a subcontracted drilling firm. Any dedicated pumps, sample lines, or instrument tubes will be removed from the selected wells before the start of drilling operations.

4.2.1 Well Drilling

New wells will be drilled with adequate diameter to allow for two casing reductions before encountering the SRPA. The diameter of the final well casings set at the aquifer must allow for coring with "PX" size core tools. After reaching the SRPA, the wells will be continually cored per the procedures in Section 4.2.2.

Decontamination of drilling equipment will be in compliance with "Decontaminating Heavy Equipment in the Field" (INEEL 1994a) and "Decontaminating Sampling Equipment" (INEEL 1994b).

Any drill cuttings, drilling fluids, or contaminated drilling equipment generated during the coring of these wells will be addressed in the Waste Management Plan for the WAG 3 OU 3-13 (DOE-ID 2000c).

4.2.2 Coring

The new wells/boreholes will be continuously cored through the first high zone of permeability below the Hi interbed, but not to exceed a depth of 30 m (100 ft) below the interbed base. Coring operations may be conducted with a wire-line core system with core size up to "PX" in diameter. A variety of coring methods may be used within the interbed material in order to maximize core recovery.

Decontamination of drilling and coring equipment will be in compliance with TPR-6574 and TPR-6575.

Any drill cuttings, drilling fluids, or contaminated drilling equipment generated during the coring of these wells will be addressed in DOE-ID 2000c.

4.2.3 Interbed Sampling

Samples for chemical analysis of the COCs will be collected from interbed materials, as will samples for physical and geotechnical analysis. It is anticipated that three sample groups will be collected at each well location, one set of all chemical and geophysical parameters samples from the top, the middle, and the bottom of the HI interbed.

Chemical analytes of interest include COCs that currently exist in the SRPA at concentrations exceeding either MCLs or risk-based concentrations, as well as COCs derived from the modeling, that are predicted to potentially cause a future unacceptable risk to the SRPA. Contaminants that currently exceed MCLs or risk-based concentrations and that will be included in the INTEC SRPA plume evaluation and modeling project are I-129, H-3, and Sr-90. Core sample material will be collected from the interior of the core in order to reduce the potential of contamination from aquifer water or drilling fluids moving within the core annular space.

Physical and geotechnical analyses will consist of a minimum of grain size, porosity estimate, bulk density, and saturated hydraulic conductivity.

Due to the difficulties inherent in the collection of samples from sedimentary interbeds, it is possible that a sufficient sample quantity to meet all analytical needs may not be available from all sample locations. Should insufficient sample material be recovered, the available sample material will be allocated to meet the following analytical requirements in the order listed:

1. Saturated hydraulic conductivity

2. Interbed chemistry samples

3. Grain size, bulk density, and porosity estimate.

If zones that have unique hydrogeologic characteristics are encountered in the HI interbed, additional samples will be taken from the HI interbed, if possible.

The QA/QC samples will be included to satisfy the QA requirements for field operations as per Section 6 of this FSP and of the QAPjP. Laboratories approved by the SMO will be used for the analyses of all samples. The QA/QC samples will be collected at the frequency recommended in the QAPjP, but not less than one set per well.

At locations USGS-112, USGS-113, and USGS-57, a total of four groundwater samples will be collected and analyzed for Tc-99 and I-129 from the HI interbed zone during the vertical profile sampling. At locations USGS-111, USGS-67, USGS-38, USGS-77, and the new well, a sample and one replicate sample will be collected from the HI interbed. The I-129 sample and the Tc-99 sample and Tc-99 replicate will be analyzed. The replicate I-129 samples will be analyzed if the Tc-99 replicate samples show significant statistical variability or the I-129 is above the action level.

The statistical evaluation of the Tc-99 replicates will follow data validation guidelines in TPR-80 for duplicate samples. The mean difference will be calculated and, if it is less than or equal to 3, then the results are considered acceptable. The mean difference is calculated from:

$$MD = \frac{|S - D|}{\sqrt{(\sigma_s^2 + \sigma_D^2)}}$$

where:

MD	=	the mean difference of the duplicate results
S	=	the original sample result (as pCi/g or pCi/L).
D	=	the duplicate sample result (as pCi/g or pCi/L).
σs	=	the associated total propagated 1σ uncertainty of the original result (as standard deviation).
σD	=	the associated total propagated 1σ uncertainty of the duplicate result (as a standard deviation).

An MD value of approximately 3 indicates that the results agree at the 3σ confidence interval and an MD value of 1 indicates that the results agree at the 1σ confidence interval. If the MD >3, the relative percent difference (RPD) will be calculated and, if the result is less than 20%, then the samples will be considered to be in agreement. The RPD is defined as:

$$\text{RPF} = \frac{\text{high result} - \text{low result X100}}{\text{average result}}.$$

4.2.4 Lithologic Logging

As the core barrel is recovered, it will be surveyed by the RCT as required by the project RCT. Once the RCT verifies no external contamination is present, the core barrel will be opened and the core or interbed material will be surveyed. Following RCT survey, the field geologist will field log the core. If contamination is detected during the radiation survey, the RCT will direct actions that are necessary to prevent further spreading of the contamination and provide control of the area. After the core has been logged, it will be placed into standard, corrugated, core-storage boxes.

4.2.5 Archive Core/Samples

Boxed core and excess interbed material will be transferred to the USGS Lithologic Core Library at CFA for archiving.

4.3 Sampling Zone Selection

The wells selected for monitoring under this FSP will undergo geophysical and fluid logging in order to determine the appropriate zones for straddle packing and sampling. Approximately 10 zones above, within, and below the HI interbed stratigraphic unit will be selected for isolation and sampling within each of the selected wells. As this project is addressing the domestic well scenario, an attempt will be made to place the upper and lower packers a standard length apart. As well screen is commonly available in 3 m (10 ft) and longer lengths, the selection of zones to isolate and sample will focus on 3 m (10 ft) vertical intervals.

Geophysical and fluid logging will be conducted by USGS logging personnel. Logging personnel are considered occasional site-workers per 29 CFR 1910.120/1926.65.

4.3.1 Geophysical Logging

Geophysical logging will be conducted to determine in situ formation conditions relevant to aquifer conductivity and interbed characteristics.

4.3.1.1 Natural Gamma Logging. Natural gamma logging will be conducted to determine the extent and location of interbeds within the lithologic column.

4.3.1.2 Caliper Logging. Caliper logging will be conducted to determine highly fractured or cavernous zones. These zones may be targeted for aquifer sample collection. In addition, competent zones with little borehole variation will be identified for packer seal zones.

4.3.1.3 Video Logging. Video logging will be conducted to visually determine highly fractured or cavernous zones. These zones may be targeted for aquifer sample collection. In addition, competent zones with little borehole variation will be identified for packer seal zones. Interbed thickness and variations may also be visible through video logging.

4.3.1.4 Deviation Logging. Deviation logging will be conducted to correct for borehole deviation on final depths for water elevations and other depth sensitive data.

4.3.2 Fluid Logging

Fluid logging will be conducted to determine in situ formation conditions relevant to aquifer flow and potential head characteristics.

4.3.2.1 Borehole Flow. Vertical flow within the borehole will be measured with heat pulse or impeller borehole flow logging equipment. Borehole flow data will be useful in modeling aquifer flow parameters and may assist in identifying zones to sample.

4.3.2.2 Specific Conductivity. Specific conductivity will be logged throughout the borehole to gather data to assist in identifying flow zones within the aquifer.

4.3.2.3 Temperature. Temperature will be logged throughout the borehole to gather data to assist in identifying flow zones within the aquifer.

4.4 Water Sampling

4.4.1 Water Elevations

Prior to sampling, all water elevations will be measured using either an electronic measuring tape (Solinst brand or equivalent) or a steel-type measure as described in SOP-11.9, "Measurement of Groundwater Levels" (INEEL 1993a). Measurement of water levels will be recorded to an accuracy of 0.01 ft. Water elevations will be corrected for measured well deviations.

4.4.2 Well Purging

All aquifer skimmer wells and straddle packer zones will be purged prior to sample collection. During the purging operation, a Hydrolab (or equivalent) will be used to measure specific conductance, pH, and temperature. Well purging procedures are provided in the current issue of TPR-6570, "Sampling

Groundwater" (INEEL 2000). A sample for water quality analysis can be collected after a minimum of three well-casing volumes of water have been purged from the well and when three consecutive water quality parameters are within the following limits:

- pH: ±0.1
- Temperature: ±0.5°C
- Specific conductance: ± 10 μmho/cm.

4.4.3 Water Sampling

Prior to sampling, all nondedicated sampling equipment that comes in contact with the water sample will be cleaned following the procedure outlined in TPR-6575, "Decontaminating Sampling Equipment in the Field." Following sampling, all nondedicated equipment that came in contact with the well water will be decontaminated prior to storage as per TPR-6575, with the exception that the isopropanol steps for decontamination will be omitted. Prior to purging, the water level in each well will be measured. The well will then be purged a minimum of three well-casing volumes until the pH, temperature, and specific conductance of the purge water have stabilized, or until a maximum of five well-casing volumes have been removed. If parameters are still not stable after five volumes have been removed, samples will be collected and appropriate notations will be recorded in the logbook.

Water samples will be collected and analyzed for specific COCs. Analytes of interest include COCs that currently exist in the SRPA at concentrations exceeding either MCLs or risk-based concentrations, as well as COCs derived from the modeling, which are predicted to potentially cause a future unacceptable risk to the SRPA. Contaminants that currently exceed MCLs, or risk-based concentrations, and will be included in the INTEC HI interbed monitoring and modeling program, are I-129, H-3, and Sr-90. The water sampling analytes and details on the analytical method and preservation requirements are presented in Table 4-2.

4.4.4 QA/QC Samples

Quality requirements will be satisfied by collecting QA/QC samples (duplicates, field blanks, rinsate, and performance evaluation samples) during the water sampling according to the schedule (stated in Table 4-3).

4.5 Pump Test

If data indicate that the COC concentration action levels in PSQ-1 of Section 3.1.2.1 are exceeded, a straddle packer pump test will be conducted of that particular zone. Only specific zones that exceed the COC action level will be pump-tested.

4.5.1 Pump Test Zone and Flow Rate

The straddle packer will be configured in the borehole to the same zone that returned samples exceeding the COCs action levels. The pump discharge will be set to a flow rate of 0.5 gpm for the duration of the test, which is 24 hours. A variable frequency pump controller will be used to control the pump discharge rate. If the formation fails to continually produce a minimum of 0.5 gpm, the test will be terminated.

4.5.2 Sample Collection

Samples will be collected during the pump test at 4-hour intervals. An initial sample will be collected after the straddle packer has been purged of three well volumes. Samples will be collected per Section 4.4.3 of this FSP. The QA/QC samples will also be collected per Section 4.4.4 (see Table 4-2).

Table 4-1. Aquifer water samples.

Analytical Parameter	Method[a]	Container Size and Type	Preservation	Holding Time	Detection Limit (pCi/L)
Tritium (H-3)	Liquid scintillation	100 ml glass bottle	None	6 months	2000
Iodine-129	Mass spectrometry	1-L amber glass bottle	None	6 months	0.1
Strontium-90	Gas flow proportional	1-L HDPE	HNO_3 to pH<2	6 months	0.8

a. Methods used for radionuclide analysis are laboratory-specific. The laboratory shall use standard operating procedures based on standard analytical methods provided to the INEEL Sample Management Office. The references that may be used to develop the Laboratory standard operating procedures are in Wells 1995.

Table 4-2. QA/QC samples.

Activity	Type	Comment
Water sampling	Duplicate	Field duplicates will be collected at a frequency of 1 per 20 samples or 1 per day, whichever is less.
	Field blank	Field blanks will be collected at a frequency of 1 per 20 samples or 1 per day, whichever is less.
	Rinsate	If the well does not have a dedicated pump, equipment rinsate samples will be collected. A minimum of 1 rinsate sample will be collected per sampling event, or 1 per day or 1 per 20 samples, whichever is less.
	Performance evaluation	Per MCP-2864, one performance evaluation sample will be submitted for each round of sampling in which radionuclide samples, other than tritium, are collected.

5. SAMPLE CONTROL

Strict sample control is required of any project as required by the project RCT. Sample control ensures that unique sample identifiers are used for each separate sample. Sample control also covers the documentation of sample collection information, so that a sampling event may be reconstructed at a later date. The following sections detail unique sample designation, sample handling, shipping, and radiological screening.

5.1 Sample Designation

A systematic identification code is crucial for the unique identification of samples. Uniqueness is required for maintaining consistency within a project and preventing the same identification code from being assigned to more than one sample.

5.1.1 Sample Identification Code

A 10-character identification code will be used for this project. The first through third characters of the code refer to sample origination information. For example, 3AW would be a sample from WAG 3 aquifer well drilling. The next five numbers designate the sequential sample number for the project. The last two characters of this set will be used to designate field duplicate samples (i.e., 01, 02). The final two characters identify a particular analysis. (Refer to the SAP tables in Appendix A for specific analysis type designations.) An example of the numbering is given for a sample collected during well drilling; this sample would be designated as "3AW00301RB" where (from left to right):

- 3AW designates the sample as originating from the WAG 3 aquifer well drilling
- 003 designates the sequential sample number (in this case the third sample collected)
- 01 designates the type of sample (01 original, 02 = field duplicate)
- RB designates the analysis to be performed (in this case, Strontium-90).

A SAP table/database will be generated to record all pertinent information associated with each sample identification code.

5.1.2 Sampling and Analysis Plan Table Database

5.1.2.1 General. The SAP table format was developed to simplify the presentation of the sampling scheme for project personnel. The following sections describe the information recorded in the SAP table/database, which will be generated for the project by the SMO.

5.1.2.2 Sample Description Fields. The sample description fields contain information relating to individual sample characteristics.

Sampling Activity. The sampling activity field contains the first six characters of the assigned sample number. The sample number in its entirety will be used to link information from other sources (field data, analytical data, etc.) to the information in the SAP table for data reporting, sample tracking, and completeness reporting. The sample number will also be used by the analytical laboratory to track and report analytical results.

Sample Type. Data in this field will be selected from the following:

- REG for a regular (REG) sample
- QC for a Quality Control (QC) sample.

Media. Data in this field will be selected from the following:

- SOIL for regular and QA/QC samples of soil, alluvium, and interbed sediments
- LIQUID for regular and QA/QC samples of pore, perched or groundwater.

Collection Type. Data in this field will be selected from the following:

- FBLK for field blanks
- CORE for undisturbed core samples
- GRAB for grab samples (grab sample from well discharge)
- RNST for rinsates
- DUP for duplicates.

Sampling Method. Data in this field are related to how the sample was collected. For example, ccore indicates continuous core. This field may be left blank.

Planned Date. This date is related to the planned sample collection start date.

Sample Location Fields. This group of fields pinpoints the exact location for the sample in the three-dimensional space, starting with the general area, narrowing the focus to an exact location geographically, and then specifying the depth in the depth field.

- **Area.** The area field identifies the general sample collection area. This field should contain the standard identifier for the INEEL area being sampled.
- **Location.** This field generally contains program-specific information such as the borehole or well identification number, but may contain geographical coordinates, x-y coordinates, building numbers, or other location identifying details. Data in this field will normally be subordinate to the area. This information is included on the labels generated by the SMO to aid field sampling personnel.
- **Type of Location.** The type of location field supplies descriptive information concerning the exact sample location. Information in this field may overlap that in the location field, but it is intended to add detail to the location.
- **Depth.** The depth of a sample location is the distance in feet from ground surface or a range in feet from the surface. The depth should reflect the pump inlet depth below ground surface for straddle packer water sampling.

5.1.2.3 Analysis Types. Sampling Table columns analysis types (ATs) 1-AT20. These fields indicate AT (radiological, chemical, etc.) and the number to be collected for each sample number. Space is provided at the bottom of the form to clearly identify each type. A standard abbreviation is also provided for each analysis below the AT cell.

5.2 Sample Handling

Analytical samples for laboratory analyses will be collected in precleaned containers and packaged according to American Society for Testing and Materials or EPA-recommended procedures. The QA samples will be included to satisfy the QA/QC requirements for the field operation as outlined in the QAPjP. Qualified (SMO-approved) analytical and testing laboratories will analyze the samples.

5.2.1 Sample Preservation

Water and interbed samples will be preserved as soon as practical after sample collection. All interbed soil, aquifer water, rinsate, and QA/QC samples will be surveyed by the RCT, logged by the FTL or Sample Team Lead, and then placed in coolers containing frozen, reusable ice packs. Samples requiring cooling, will be maintained at 4°C (39°F) from the time of sample collection, through sample shipment, and to the time of sample receipt at the analytical laboratory. Samples requiring chemical preservation (i.e., addition of nitric acid to samples for strontium) will be transported to CFA-625 for preservation. After preservation, sample bottles will have CoC seals attached.

5.2.2 Chain-of-Custody Procedures

The CoC procedures will be followed per TPR-4911, "Chain-of-Custody and Sample Labeling for ER and D&D&D" (INEEL 1997e), TPR-4908, "Handling and Shipping Samples for ER and D&D&D" (in preparation) and the QAPjP. Sample containers will be stored in a secured area accessible only to the field team members.

5.2.3 Transportation of Samples

Samples will be packaged in accordance with the requirements set forth in TPR-4908 (in preparation) and TPR-4911, and will be shipped in accordance with the regulations issued by the U.S. Department of Transportation (49 CFR Parts 171 through 178).

5.2.3.1 Custody Seals. Custody seals will be placed on all shipping containers in such a way as to ensure that tampering or unauthorized opening do not compromise sample integrity. Clear plastic tape will be placed over the seals to ensure that the seals are not damaged during shipment.

5.2.3.2 On-Site and Off-Site Shipping. An on-Site shipment is any transfer of material within the perimeter of the INEEL. Site-specific requirements for transporting samples within INEEL boundaries and those required by the shipping and receiving department will be followed. Specific requirements for off-Site shipment of samples will be coordinated with the Packaging and Transportation personnel.

5.3 Radiological Screening

Following sample collection, samples will be surveyed for external contamination and field screened for radiation levels. If necessary, a gamma-screening sample will be collected and submitted to the Radiation Measurements Laboratory located at Test Reactor Area-620 for a 20-minute analysis prior to shipment off-Site. Determination of the need for Radiation Measurement Laboratory screening will be made by the RCT in the field. If it is determined that the contact readings on the samples exceed 200 mR/hour beta/gamma, then the samples will be held for analysis in the INTEC Remote Analytical Laboratory.

6. QUALITY ASSURANCE/QUALITY CONTROL

A QAPjP has been developed for INEEL WAGs 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites (DOE-ID 2000a). This plan pertains to all environmental, geotechnical, geophysical, and radiological testing, analysis, and data review. This section details the field elements of the QAPjP to support field operations during the implementation of this FSP.

6.1 Project Quality Objectives

This section specifies what measurements must be met to produce acceptable data for this project. The technical and statistical qualities of those measurements must be properly documented. Precision, accuracy, and completeness are quantitative parameters that must be specified for physical/chemical measurements. Comparability and representativeness are qualitative parameters. QA objectives for this project will be met through a combination of field and laboratory checks. Field checks will consist of collecting field duplicates, equipment blanks, and field blanks. Laboratory checks consist of initial and continuing calibration samples, laboratory control samples, matrix spikes, and matrix spike duplicates. Laboratory QA is detailed in the QAPjP and is beyond the scope of this FSP.

6.1.1 Detection Limits

The detection limits needed in order to make decisions concerning the need for the contingent remedy are $1/10^{th}$ of the individual MCLs for the specific contaminates. Therefore, the required detection limits are

- I-129: 0.1 pCi/L
- SR-90: 0.8 pCi/L
- H-3: 2000 pCi/L.

6.1.2 Field Precision

Field precision is a measure of the variability not due to laboratory or analytical methods. The three types of field variability or heterogeneity are spatially within a data population, between individual samples, and within an individual sample. Although the heterogeneity between and within samples can be evaluated using duplicate and/or sample splits, overall field precision will be calculated as the relative percent difference between two measurements or relative standard difference between three or more measurements. The relative percent difference or relative standard difference will be calculated, as indicated in the QAPjP, for duplicate samples during the data validation process. Precision goals have been established for inorganic Contract Laboratory Program methods by the EPA (EPA 1993) and for radiological analyses in the SMO TPR-80, "Radiological Data Validation."

Duplicate samples to assess precision will be co-located and collected by field personnel at a minimum frequency of one duplicate for every 20 samples or one duplicate sample per well set, whichever is less. These duplicates will be collected for both water (blanks) and soil (interbed) matrices. Sample identifications are provided in the SAP table presented in Appendix A.

6.1.3 Field Accuracy

Cross-contamination of the samples during collection or shipping could yield incorrect analytical results. To assess the occurrence of any cross-contamination events, equipment and field blanks will be collected to evaluate any potential impacts. The goal of the sampling program is to eliminate any cross-contamination associated with sample collection or shipping. To assist in this, wells will be sampled from the least contaminated area (lateral boundary wells) to the most contaminated (modeled HI interbed hot spot). If necessary, the data will be blank-qualified to indicate the presence of cross-contamination. Field personnel will collect equipment and field blanks during the course of the project. Trip blanks will not be collected since no volatile organic compounds are scheduled for analysis. The equipment and field blanks will be collected at a frequency of one per every 20 samples, or one sample blank for every sample day, whichever is less.

6.1.4 Representativeness

Representativeness is evaluated by assessing the accuracy and precision of the sampling program and expressing the degree to which samples represent actual site conditions. In essence, representativeness is a qualitative parameter that addresses whether the sampling program was properly designed to meet the DQOs. The representativeness criterion is best satisfied by confirming that sampling locations are selected properly and a sufficient number of samples are collected to meet the requirements stated in the DQOs. The DQOs are identified in Section 3.1 of this FSP.

6.1.5 Comparability

Comparability is a qualitative measure of the confidence with which one data set can be compared to another. These data sets include data generated by different laboratories performing this work, data generated by laboratories in previous studies, data generated by the same laboratory over a period of several years, or data obtained using differing sampling techniques or analytical protocols. For field aspects of this program, data comparability will be achieved using standard methods of sample collection and handling. Procedures identified to standardize the sample collection and handling included TPR-6570, "Sampling Groundwater," (INEEL 2000), TPR-6565, "Core Subsampling," (INEEL 1993b), TPR-4908, "Handling and Shipping Samples for ER and D&D&D," (in preparation) and TPR-4911, "Chain-of-Custody and Sample Labeling for ER and D&D&D" (INEEL 1997e).

6.1.6 Completeness

Field completeness will be assessed by comparing the number of samples collected to the number of samples planned. Field sampling completeness is affected by such factors as equipment and instrument malfunctions and insufficient sample recovery. Completeness can be assessed following data validation and reduction. The completeness goal for this project is 100% for critical activities and 90% for noncritical activities. A critical activity for this project is defined as the successful installation of a monitoring well, deepening of four existing wells, successful identification of sample horizons via geophysical and fluid loggings, and successful packer deployment. A noncritical activity is defined as the successful collection of an individual sample.

6.2 Field Data Reduction

The reduction of field data is an important task to ensure that errors in sample labeling and documentation have not been made. This includes cross-referencing the SAP table with sample labels, logbooks, and the CoC forms. Prior to sample shipment to the laboratory, field personnel will ensure that all field information is properly documented.

6.3 Data Validation

All laboratory-generated data will be validated to Level B. Data validation will be performed in accordance with GDE-7003, "Levels of Analytical Method Validation." The procedure for validating radioanalytical data is TPR-80, "Radioanalytical Data Validation." Field-generated data (e.g., water levels) will be validated through the use of properly calibrated instrumentation, comparing and cross-checking data with independently gathered data, and recording data collection activities in a bound field logbook.

7. WASTE MANAGEMENT

Remediation waste generated during the OU 3-13 Group 5 SRPA monitoring well sampling project may include the following:

- Contaminated PPE, wipes, bags and other refuse
- Contaminated sampling equipment
- Noncontaminated paper and plastic trash
- Aqueous decontamination solutions
- Used sample containers and disposable sampling equipment
- Aqueous and liquid analytical wastes
- Analytical debris (for example, glassware, pipettes)
- Purge water
- Potentially contaminated equipment.

The disposition and handling of waste for this project will be consistent with the *Waste Certification Plan for the Environmental Restoration Program* (INEEL 1997f) and the project-specific Waste Management Plan (DOE-ID 2000c). However, field personnel will be responsible for the initial segregation of waste based on sampling conditions and/or location. The segregation of waste will play an important role in the reduction of waste generated by this project. As such, waste minimization and segregation are discussed below.

7.1 Waste Minimization and Segregation

Waste minimization for this project will be primarily achieved through design and planning to ensure efficient operations and ensure wastes are not generated unnecessarily. Sampling personnel will be responsible for segregating conditional industrial wastes from contaminated wastes. All contained wastes will be marked with information regarding the area from which it was generated. This will facilitate proper classification of the wastes following receipt of sampling and analysis results. Field personnel will be responsible for segregating contaminated liquid wastes from nonliquid wastes and contaminated combustible solid wastes from noncombustible solid wastes. All waste containers will be labeled with information regarding the characteristics of the wastes (for example, liquid, combustible solid, or noncombustible solid). Decontamination fluids from potentially contaminated equipment will be contained separately from decontamination fluids generated from noncontaminated areas. Sampling, drilling equipment, and debris that cannot be decontaminated in accordance with the field procedure will be contained for subsequent management.

8. HEALTH AND SAFETY

Work performed under the Plume Evaluation FSP for OU 3-13, Group 5, SRPA will be performed in accordance with the project-specific HASP (INEEL 2002).

9. DOCUMENT MANAGEMENT

This section summarizes document management and sample control. Documentation includes field logbooks used to record field data and sampling procedures, CoC forms, and sample container labels. The analytical results from this field investigation will be documented in reports and used as input for defining the current conditions for the computer model.

9.1 Documentation

The FTL will be responsible for controlling and maintaining all field documents and records, and verifying that all required documents to be submitted to the contractor ER ARDC are maintained in good condition. All entries will be made in indelible black ink. Drawing a single line through the error and entering the correct information will correct entry errors. All corrections will be initialed and dated.

9.1.1 Sample Container Labels

Waterproof, gummed labels generated from the SAP database will display information such as the unique sample identification number, the name of the project, sample location, and analysis type. Labels will be completed and placed on the containers in the field before collecting the sample. Sample team members will provide information necessary for label completion. Such information may include sample date, time, preservative used, field measurements of hazards, and the sampler's initials.

9.1.2 Field Guidance Form

Field guidance forms verifying unique sample numbers provided for each sample location can be generated from the SAP database. These forms contain the following information:

- Media
- Sample identification numbers
- Sample location
- Aliquot identification
- Analysis type
- Container size and type
- Sample preservation.

9.1.3 Field Logbooks

Field logbooks will be used to record information necessary to interpret the analytical data in accordance with ARDC format, and controlled and managed according to TPR-4910, "Logbooks for ER and D&D&D Projects" (INEEL 1996a).

9.1.3.1 Field Team Leader's Daily Logbook. A project logbook maintained by the FTL will contain a daily summary of the following:

- All field team activities

- Visitor log
- List of site contacts
- Problems encountered
- Any corrective actions taken as a result of field audits.

This logbook will be signed and dated at the end of each day's sampling activities.

9.1.3.2 Sample Logbooks. Sample logbooks will be used by the sample team(s). Each sample logbook will contain information such as the following:

- Physical measurements
- All QC samples
- Sample information (sample location, sample collection information, analyses requested for each sample, and sample matrix)
- Shipping information (collection dates, shipping dates, cooler identification number, destination, CoC number, and name of shipper).

9.1.3.3 Field Instrument Calibration/Standardization Logbook. A logbook containing records of calibration data will be maintained for each piece of equipment requiring periodic calibration or standardization. This logbook will contain log sheets to record the date, time, method of calibration, name of the calibrating individual, and instrument identification number.

9.1.4 Photographs

It is not anticipated that formal photographic records of the activities under this FSP will be made. Photographs may be taken by field personnel to record general equipment setups and installation procedures. A minimum of two copies will be made of any photographs taken during this project. One copy will be placed in the project file; the second copy will accompany other project documents (that is, field logbooks) to be placed in the ARDC.

9.2 Document Revision Requests

Revisions to this, or any referenced document, will follow MCP-230, "Environmental Restoration Document Control Center Interface" (INEEL 1996b).

10. PROJECT SCHEDULE

This section addresses the schedule for completion of this project. Also discussed is the order of completion for each of the tasks outlined above. It is anticipated that this project will be completed over a period of approximately six to twelve months. This assumes that sampling will occur concurrently with drilling at multiple well locations. As noted in Section 4.0, the borehole will be advanced into the HI interbed at each location, and then sampling and pump testing will be conducted over the interbed zone. After the completion of the pump testing and sampling of the interbed zone, the borehole will be advanced to final depth. A suite of geophysical and fluid logs will then be conducted within the borehole. Straddle packing and sampling of specific zones within the borehole will be conducted following the geophysical and fluid logging. After completion of the straddle packer sampling, the well will be completed as specified.

The approximate estimated schedule for individual activities is as follows:

- The drilling and installation of the new wells may require up to 6 months to complete
- A truck-mounted pump service rig will require up to two months to collect discreet straddle packer vertical profile samples from all wells
- Three months will be required for sample analysis and the data evaluation needed for the selection of pump test zones
- A truck-mounted pump service rig will require one to two months to accomplish the individual 24-hour-pump tests.

It is possible that variations in the stratigraphy and lithology of the subsurface materials encountered during drilling may expedite or delay this schedule. Other parameters that may cause acceleration or delay of this schedule include such things as analytical laboratory turnaround times, ease or difficulty of isolating specific zones for straddle sampling, and the final number of zones requiring the completion of 24-hour-pumping tests.

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